Educational Psychology

Its Problems and Methods

By

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Third Edition, completely revised and rewritten

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To

MY MOTHER

FROM PREFACE TO FIRST EDITION

THE purpose of the present volume is to consider the contribution made by experimental psychology to the study of educational problems. In the last quarter of a century the volume of experimental work has expanded to such an extent that it is becoming wellnigh hopeless to get a conspectus of the position Much of this work has reference direct or indirect to educational matters, and it is hoped that the survey here attempted may help the student of education to find his bearings in this territory

Enthusiastic experimenters are apt to forget that wisdom did not delay its entrance into the world until the reign of experimental psychology, and that the experience of practical teachers gives them an insight into the mentality of youth obtainable in no other way. Nevertheless, the value of experimental observation cannot be gainsaid, and the science of education must take into account the evidence acquired by exact methods. . . . Wherever possible, I have given historical details, believing that some psychological problems cannot be adequately understood without historical treatment. . . . In many cases I have indicated where the next line of advance seems to me most profitable, and the text contains several previously unpublished experiments. With the same object in view, I have ventured, as a stimulus to research, to suggest a new view of mental imagery and a new theory of mental fatigue. . . .

PREFACE TO THIRD EDITION

THIS edition has been so completely revised, and greatly enlarged, that it is practically a new book. In order to keep it to a reasonable size the chapter on Mental Fatigue has been omitted; but those who are interested will find a full treatment, under the heading 'Mental Energy', in my recent book on *The Mind and its Body*. Two new chapters have been added—on 'Mental Heredity' and 'Mental Tests'. Mental heredity is the kernel of many problems in educational psychology, whilst mental tests have branched out into so many diverse ways, including child and vocational guidance, that it seemed necessary to treat them much more fully.

In every chapter I have emphasised the underlying psychological principles, since, without these, the perspective of psychological experiment is apt to be distorted. It is just as essential to be able to evaluate experimental findings as to know how they are arrived at. This is well illustrated by the consideration of mental tests. Their mathematical treatment has developed to such an extent that the student is apt to miss the psychological wood in the tangle of statistical trees. It is shown, in the text, that it is possible to reconcile some of the disputes in the statistical theory by psychological considerations; and thus a new theory of what mental tests measure is put forward in the last chapter. Again, whilst taking account of recent experimental investigations, and giving them their due weight, I have not ignored the gains of the past, but have tried to weave the two together. For this reason the first chapter, which deals with principles, has been expanded, and is constantly referred to in all the later chapters. The various problems, which at first sight appear so diverse, are thus unified.

Owing to the general interest in the subject, the doctrines of psycho-analysis have been submitted to a more thorough examination, especially as regards their underlying theory. The results of this investigation reveal the weakness of the psychological foundations; but the therapeutic superstructure, which is valuable, is outside the purview of this book. The chapter on Æsthetics has been greatly enlarged, in order to deal with recent attempts to give purely psychological theories of beauty and other forms of value. The recognition of the importance of the æsthetic side of education is an outstanding feature of the modern curriculum; and we are only at the beginning. The student of educational psychology ought to be fully equipped to understand and evaluate any future suggestions in this direction.

During the last decade the doctrine of human instincts has undergone a profound change. The earlier editions of this book merely suggested that the accepted doctrine was not sound. In this edition a new section, treating the topic more fully, has been added to the chapter on Habit where, in my opinion, it rightly belongs. There it is shown that the concept of human instinct cannot be understood without sound principles concerning the nature of mental heredity, and that man's biological structure is inadequate as an explanation of human motives. Conduct is determined by attracting more than by propelling forces, that is, by ideas and ideals rather than physiological mechanisms.

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CHAPTER I

MENTAL DEVELOPMENT

Theories of the Nature of Mind—(*a*) Compartment Theory—(*b*) Faculty Theory—(*c*) Association Theory—(*d*) Structure Theory—(*e*) Configuration Theory

THEORIES OF THE NATURE OF MIND

THE student of educational psychology will find his path beset with insuperable difficulties unless he has clear ideas on the nature of mental development. There is hardly a problem in connection with the subject of our study which does not assume some theory of development, and our first task must be to examine the different views which have been accepted in the past or are now current It is the special danger of workers in applied science to accept principles without sufficient investigation and thereby to perpetuate age-long errors. In the course of this book we shall have ample opportunities of observing the confusion which has been caused by accepting mistaken psychological theories as though they were profound educational truths

There are five theories of the nature and growth of mind which need examination in this preliminary survey owing to the fact that they are frequently employed consciously or

unconsciously in the application of psychology to educational topics. They will be referred to as

(a) The Compartment Theory;
(b) The Faculty Theory;
(c) The Association Theory;
(d) The Structure Theory;
(e) The Configuration Theory.

(a) *The Compartment Theory*

The compartment theory is so primitive that it seems difficult to believe that such a view of the nature of mind could have been resuscitated in a scientific age. According to this view the mind is regarded as a kind of receptacle composed of different compartments, each of which is able to store a definite amount of mental material of a particular sort. The nature of the material is not always clearly indicated but it is frequently supposed to consist of ideas, images, affects and so on. The various receptacles are assumed, in a loose way, to have a more or less definite volume permitting only a certain number of the contents to be stored in them. If more are put in some must be squeezed out; but sometimes the images and ideas are regarded as being of a sort of gaseous nature so that more can be forced in under pressure. Mental development consists of acquiring the mental elements and arranging them into their proper compartments, after the fashion of the files in an office, for convenience of reference. Sometimes the compartments are dignified by the name of systems, but the underlying idea is the same.

Lest it should be imagined that nobody could conceivably adopt this view I give a quotation from the exponent of the most recent revival of the compartment idea. "The unconscious system of the mind," says Professor Freud,[1] "may be compared to a large ante-room in which the various mental excitations are crowding upon one another, like individual

beings. Adjoining this is a second, smaller apartment, a sort of reception-room, in which, too, consciousness resides. But on the threshold between the two there stands a personage with the office of door-keeper, who examines the various mental excitations, censors them, and denies them admittance to the reception-room when he disapproves of them. . . . The excitations in the unconscious, in the antechamber, are not visible to consciousness, which is, of course, in the other room, so to begin with they remain unconscious. . . . But even those excitations which are allowed over the threshold do not necessarily become conscious; they can only become so if they succeed in attracting the eye of consciousness. This second chamber, therefore, may be suitably called the pre-conscious system." Although we are told that consciousness resides in the reception-room, apparently the ideas and images (or excitations, which are queer things) do not awaken until, like the princess in the fairy tale, they have received the kiss of consciousness, rubbed their eyes and passed into a third compartment. What consciousness is apart from the contents of consciousness is a deep, not to say meaningless, mystery. But this does not concern us at present.

This spatial notion of a series of compartments, owing to the ease with which it may be visualised has captured the popular imagination; and the theory of unconscious ideas which have all the characteristics of ideas as we know them, except that of being conscious, and residing in some dark cavern, is widely accepted as sound psychology. Most exponents of psycho-analysis accept this compartmental view as a true representation of mental structure, and combine it with a further belief that a corresponding structure is found in the nervous system. Not so Professor Freud,[2] who warns us that, "We may give free rein to our assumptions provided that we at the same time preserve our cool judgment and

do not take the scaffolding for the building." But few of his followers remember this advice of the master. In dealing with functional diseases of the nervous system it is no doubt desirable for the practitioner to have a visual symbol in order to help in the analysis of the various complicated activities displayed in the psycho-neuroses. If the time relations of these activities can be conceived as split up into minor activities which exhibit a definite time sequence, it is useful to symbolise the time relations by a spatial diagram. Thus, if the origin of a certain phobia in an adult can be traced to some event occurring in his childhood it may be convenient, as a rough and ready mnemonic, to represent the original event as an idea persisting in an unconscious state, for that will help to keep the cause in mind and will be useful for future reference. But, strictly speaking, there is no need whatever to assume a real spatial arrangement of the psychic system, or to suppose that the mnemonics in any way resemble the structure of the living mind. In order not to be misled by the specious simplicity of all this spatial symbolism the student of educational psychology must remember that "these comparisons are designed only to assist us in our attempt to make clear the complication of the psychic activity by breaking up this activity and referring the simple activities to the single component parts of the apparatus." [3] In brief, the various compartments are a device for representing spatially a series of time relations and should never be used for any other purpose. To build up a theory of mental processes on such a basis is like the attempt of the friends of an engaged couple to study the characteristics of their future children from a survey of the scaffolding of the house they are building.

Freud is not only a great physician but a stimulating teacher and knows the didactic value of illustrations. He appears also to think by means of diagrams, and in his latest

exposition of mental structure, which he characteristically describes as the anatomy of the personality,[4] he gives a neat diagram as a summary of his views, a sound mnemonic device, but he adds: "When you think of this dividing up of the personality you must not imagine sharp dividing lines such as are artificially drawn in the field of political geography. We cannot do justice to the characteristics of the mind by means of linear contours, such as occur in a drawing or in a primitive painting, but we need rather the areas of colour shading off into one another that are to be found in modern pictures. After we have made our separations, we must allow what we have separated to merge again. Do not judge too harshly of a first attempt at picturing a thing so elusive as the human mind" Such merging into one another of mental events, which led William James to talk of the "stream of consciousness," is so fundamental a property of mind that any account of mental development which ignores it is unscientific and misleading.

(b) *The Faculty Theory*

Though the theory of mental activity as consisting of a congeries of independent mental entities, called faculties, has been definitely repudiated by competent people it has a persistent way of cropping up again. Moreover, the terminology associated with the theory is often valuable for descriptive purposes, as it would be difficult, without tedious circumlocution, to avoid speaking of the imagination, the judgment, the intelligence, etc. Thus it is desirable to see how the theory arose, and we are fortunate in having an illuminating account by Professor C. Spearman in *The Abilities of Man*.[5]

He traces the doctrine back to Plato, who recognised two main faculties, sensory perception and intellect; the latter separating man from the brutes. To these Aristotle added

the faculty of movement. Just as we distinguish between potential and kinetic energy, so the ability to put intellect into motion was later called the faculty of intelligence. Memory was subsequently added to this trio, and then imagination in the sense of invention. Quintilian, in the first century A.D., regarded the memory as the child's most conspicuous faculty, which, therefore, should be exercised by education to strengthen it. Two further faculties were added in Roman times, namely speech and attention. Additions to these historic seven were made by subdividing them. Thus the schoolmen divided the intellect into the separate faculties of conception, judgment and reasoning; a division which is still to be met with in books on logic.

By the 17th century so many faculties had been smuggled into the regions of philosophy and science by their advocates that they had become a nuisance, and Leibniz[6] was moved to protest. "These accounted for appearances by expressly fabricating suitable occult qualities or faculties, which were supposed to be like little demons or sprites able to do what was required of them out of hand—just as if there were watches able to tell the time by some 'horodeictic faculty' without the need of wheels, or mills able to crush grain by a 'fractive faculty' without the need of anything in the nature of millstones."

Each of the faculties was regarded as an unanalysable entity capable, in a mysterious way, of performing some definite function; so that a man endowed with imagination, for instance, could use it in any sphere of activity to which he chose to apply himself; an assumption we shall examine in a later chapter. Another form which the faculty theory has taken in recent years is the doctrine of separate entities known as instincts. Thus the various acts of pugnacity, curiosity, fear and what not, are each subsumed under one heading, despite their obvious qualitative variations, and

given the same name. The class name of all acts of pugnacity is then assigned to some independent entity, called the instinct of pugnacity, which is supposed to produce them all. By this transformation of general names into active powers a whole array of new faculties, called instincts, has been added to the mind, capable like little demons of carrying out their tasks without further help.

The criticism of Locke on this matter has never been bettered and therefore I quote from the Essay concerning Human Understanding [7] "For, it being asked, what it was that digested the meat in our stomachs? it was a ready and very satisfactory answer to say that it was the *digestive faculty*. And so in the mind, the *intellectual faculty* or the understanding, understood, and the *elective faculty*, or the will, willed or commanded. This is in short, to say, that the ability to digest, digested; and the ability to understand, understood. For faculty, ability and power, I think, are but different names of the same things, which way of speaking, when put into more intelligible words, will, I think, amount to thus much: That digestion is performed by something that is able to digest . . . understanding by something able to understand. And, in truth, it would be very strange if it should be otherwise."

Since the faculties were intended to express the activity of the mind as shewn in the variety of functioning, if we abandon the use of them we must be prepared to attribute some power to the subject himself. Certain modern psychologists have, however, emptied the baby together with the water of the bath. Not only do they reject the complex faculties of memory imagination and the like, but they deny all power whatsoever to the mind, and fondly imagine that they can explain mental events without reference to mental activity. But this is ridiculous, and no amount of talk about ideas acting, or images doing this or that, such as disappearing into the unconscious

and reappearing again like the actors on a stage can dispense with the notion of subjective activity. As to the attempt to father all the mental activity displayed by a living mind on to its physiological substratum the brain, that is but an instance of the absurd attempt to explain function by structure, which we shall consider later. The nervous system is doubtless a necessary condition of mental functioning, but to regard it as the sole sufficient condition is erroneous. We shall see as we proceed, that many of the difficulties which educational psychology is heir to originate in the denial of mental activity, or the attempt to substitute nervous activity in its place.

It has been recognised for some time that in order to describe experience we require at least three ultimate descriptive terms. From the days of Aristotle two aspects of experience had been recognised, namely the cognitive and the conative, but Rousseau forced attention to the third aspect by insisting on the rights and importance of the life of feeling in opposition to the view that feeling was a kind of obscure thought or confused impulse.[8] Since the time of Kant, who first applied the three descriptive terms consistently, psychologists have recognised cognition, feeling and conation as three attitudes which a person adopts in so far as he is mentally alive. But, though these are analytically distinguishable, in experience they are never found apart. The suggestion has been made that these should be called the ultimate faculties of the mind; but as this would imply a separation which, in fact, never occurs, it is more conformable with common sense to regard them merely as descriptive terms with which to characterize the various subjective aspects of experience.

(c) *The Association Theory*

After running riot in Scottish psychology the faculties were finally laid to rest by the association theory. The history of the "association of ideas" in psychology is a terribly long

and varied one.[9] Aristotle in a treatise on Memory had noticed that "when we are recollecting we keep stimulating certain earlier experiences until we have stimulated one which the one in question is wont to succeed. And just so we hunt through the sequence, thinking along from the present or some other thing, and from similar or contrasted or contiguous" Centuries elapsed and Descartes introduced the notion that association was entirely a matter of brain physiology. "The vestiges in the brain," said he, "render it fit to move the soul in the same fashion as it was moved before, and thus to make it remember something, even as the folds which are in a piece of paper or a cloth make it more fit to be folded as it was before."[10] This conception has been accepted uncritically by most schools of psychology especially by some which pride themselves on being up to date.

When the association psychology was introduced into Great Britain in the middle of the 18th century by Hartley in his *Observations on Man* its ultimate result was to give the quietus to the Scottish school which explained every conceivable mental act as due to a separate faculty. Thenceforward, in England and France, until the last quarter of the 19th century, theories of philosophy, ethics, law and education were permeated by the belief that all the most complex forms of mental life could be adequately accounted for by the mechanical union of simpler states. It is true that the doctrine of 'mental chemistry,' by which the simpler states were supposed to be combined in a manner analogous with the composition of chemical elements in a compound eliminated some of the more obvious failings. But neither this modification nor the doctrine of evolution with which it was later combined, so that the higher mental powers were regarded as evolved from the simpler, made any real difference to the associationists; for no new principle except associationism was introduced, but the results of the association were merely supposed to be

carried on from generation to generation. The wide extent of the principle may be gathered from a remark of J. S. Mill [11] commenting on the doctrines of his father, the classical English associationist. "In psychology his fundamental doctrine was the formation of all human character by circumstances, through the universal Principle of Association, and the consequent unlimited possibility of improving the moral and intellectual condition of mankind by education." For, if the mechanical association of ideas is the sole factor involved, it is clear that by providing the opportunities for making the correct associations, we are doing all that we possibly can for intellectual and moral development, and we may make intelligence and character to order

Although the doctrine of association of ideas as an explanatory principle was worked to death by the English school, Locke, who incidentally introduced the term, dealt with it not to explain knowledge but to account for human error. According to him ideas, whether rationally related or not, may, by the force of habit, be so united in an individual mind that it is impossible to separate them. "They always keep in company, and the one no sooner at any time comes into the understanding, but its associate appears with it; and if they are more than two which are thus united, the whole gang, always inseparable, shew themselves together." [12] Such connection, which varies from person to person, is dependent on inclinations, education and interest. He gave as an illustration the association of "goblins and sprites" with darkness: "Let but a foolish maid inculcate these often on the mind of a child, and raise them there together, possibly he shall never be able to separate them again so long as he lives."

As used by the classical English school, association referred primarily to those sequences of presentations which occur in memory, imagination or thought, but was not confined to

these. It was also used to cover the connection between sensations and movements or movements and ideas, and ultimately to explain the formation of habits. Thus Hartley illustrated the principle by shewing how the child learns to speak. He hears the word *mother* constantly when he sees her, consequently it was assumed that the visual sensation would stimulate the muscular movements of articulation; or, later on, the mental image of his mother would be sufficient to set off the train of movements. In this simple way the whole structure of our memory and thought was supposed to be built up. What the associationists forgot, however, was that the child made the association because he had an innate impulse to speak, and was interested in his mother as the source of all his joys; so that not the bare conjunction of the "ideas" but the eagerness to satisfy an impulse was the real cause of the association.

Various forms of association have been enumerated, such as association by contiguity, similarity, contrast, etc., but the only ultimate 'law of association' is association by contiguity. The so-called association by similarity is a *result* observed by comparing the ideas *after* they have been recalled, and not therefore a cause of the revival; as when the chimes of a clock remind me of the bells of Big Ben, which comparison I now make for the first time, i.e. after the association has been made. Contiguity, however, either in space or time, is no real ground of association, but simply provides the opportunity for the person to attend to the presentations in immediate succession, thus facilitating their recall.

It is very tempting to try to account for association wholly in terms of brain structure, and theories of this kind spring up again and again. The most thorough attempt is that of Professor Semon. He calls any enduring modification in living substance, after it has been submitted to a stimulus, a mnemic trace or engram, and the process by which

future stimuli touch off the engrams is known as ecphory. The principle of association is summed up in two ultimate mnemic laws. "All simultaneous excitations within an organism leave behind a connected engram-complex, constituting a coherent unity" and "The partial recurrence of the excitation-complex which left behind it a simultaneous engram-complex acts ecphorically on the latter whether the recurrence be in the form of original or mnemic excitations." Perhaps the meaning of the latter law may best be understood by an example. If I hear the phrase "all that glitters" I mentally supply its completion Now the stimulus to the first word of the phrase "is not gold" is regarded as the auditory sensation of the preceding word, whilst the stimulus to the word *gold* is supposed to be the mnemic excitation set up in the engram-complex *is not gold.* This latter engram-complex has been 'left behind' in my brain in accordance with the first law. So, to take a more primitive example, when a child simultaneously sees his nurse and receives food, both the optical stimulus and the taste stimuli produce their engraphic effects, and the engrams are permanently associated. But all this leaves out the essential part of the process. Unless the child were interested both in the nurse and the food, and more especially in the fact that these somehow go together, the association would never be made. The attention to the combined stimuli which makes them parts of one interesting whole is the ultimate cause of the association. Thenceforward the sight of the nurse will act ecphorically to determine attention to the foretaste of the coming food.

The fundamental defect of the association theory lay in the denial, explicit or implicit, of mental activity or subjective selection amongst the 'ideas.' It was an attempt to account for the growth and development of mind on the ground of a marriage union between sensations, ideas, images, movements, etc. which act on their account, the person being

passive in the process. Thus Bain, one of the chief exponents, stated the law of Association by Contiguity which as we saw is the ultimate law of all mental association thus: "Contiguity joins together things [he meant sensations, images, etc.] that occur together, or that are, by any circumstance, presented to the mind *at the same time*." [13] It was never explained what particular virtue resided in mere "Contiguity" which enabled it to do anything in the mental world. How "ideas" could "associate" themselves remained and remains an inexplicable mystery. Quite recently a new school of psychologists arose in America, the behaviourists, who dug up the corpse of associationism and thought that by substituting 'movements' for 'ideas' the remains could be revived and 'behave' as though they breathed the breath of mental life. But the carcase refused to function and simulate mental activity, though it was provided for the purpose with explicit movements, and, where these failed, with an illicit collection of implicit movements to do the work.[14]

(d) *The Structure Theory*

According to this view, in its crudest form the mind is considered as a kind of structure having a form gradually built up in the course of experience. Part of the plan of structure has already been laid down by the race before individual experience begins, so that the subject does not start *de novo* but inherits a fabric which he proceeds to extend still farther. In order to realise how this idea arose it is necessary to refer to the hypothesis of *mental dispositions*. When a man is said to know mathematics, for instance, we do not mean that he is at that moment thinking of the subject, for he may be reading a novel. What we mean is that he is capable of calling to mind certain mathematical propositions as he requires them and of forming correct judgments about mathematical ideas. So, again, suppose I meet a man for the

first time and then forget all about him, on a future occasion I may recognise him although there may be nothing to shew in the interval that my mind is affected in any way. In both these, and in all similar cases, some psychologists as we saw assume that previous experience leaves behind some trace which determines subsequent mental processes, and such after-effects are called dispositions It is important clearly to realise that we have, so far, no independent means of knowing of the existence of the dispositions except by their effects. Or, rather, it would be better to say that the sole reason for assuming their existence is to enable us to give a connected instead of a piecemeal account of the facts of mental life. Hence to call them 'engrams' or to refer to them by any other descriptive name such as 'unconscious mental modifications' as is frequently done, is surreptitiously to assign to them certain hypothetical properties.

A man's present consciousness is determined by a set of conditions which are not completely enumerated when we have assigned all that is present at that moment to his mind. Thus if one tries to remember what one had for breakfast, the possibility of recalling the various items of the meal, with a sense of recognition, is due mainly to what happened in the morning, and is only partially accounted for by the present situation and the effort to remember. Hence the recollection is an instance of what has been happily called 'mnemic causality.' To illustrate this, suppose "you smell peat-smoke and you recall some occasion when you smelt it before. The cause of your recollection, so far as hitherto observable phenomena are concerned, consists both of the peat-smoke (present stimulus) and of the former occasion (past experience). The same stimulus will not produce the same recollection in another man who did not share your former experience. . . . According to the maxim 'same cause, same effect,' we cannot therefore regard the peat-smoke alone as the cause of

your recollection, since it does not have the same effect in other cases. The cause of your recollection must be both the peat-smoke and the past occurrence." [15] All habits are examples of such mnemic causality, since it is possible to account for a present habitual act by referring to the occasions on which it was practised in the past.

It would be possible by the help of the notion of mnemic causation to describe mental development without recourse to any permanently enduring latent mental traces. However, our descriptions would be intolerably long, as we should be forced to include much of a person's past mental history in any attempt to explain his present activities, and for inherited abilities we should have to include the history of the race. To avoid this it is convenient to assume the existence of dispositions. By doing this we are following in the wake of the physicists, who suppose that energy which they attribute to steam owing to its capacity to do work must be caused by the heat which was used up in changing water into steam. The heat has disappeared, but the steam can do work, and to bridge the gap between heat and work the concept of energy is necessary. For a precisely similar reason the concept of mental dispositions is helpful to psychologists. So much may be conceded, but all else that is implied in the structure theory is far-fetched hypothesis mingled with much error

The ablest exposition of the structure theory is that given by Professor McDougall,[16] and since he shews more insight than others it will be as well to examine his account According to him, "The perfectly developed and organised mind would have a cognitive disposition for every individual object and for every species, genus, and class of objects, and these would not be a mere unorganised crowd of dispositions, but would be related in a perfectly definite treelike system " This is a great refinement on any inorganic structure, such as we originally assumed, and is so far to the good; for any sound

theory of the mind, since it is alive, must shew analogies with living organisms. We learn further that the structure grows "like a tree that puts out new twigs from the stem, forming new growing points, which in turn divide; until in the developed human mind the structure is like a vast tree." It is a pity that this suggestive figure was not left as it stands, for in the attempt to elaborate it much of its value is lost. The final picture is painted thus "The facts of mental structure require for their diagrammatic representation a three-dimensional diagram. As such a diagram we may take a bush woven over by a multitude of spider's threads, stretching from leaf to leaf, each leaf being directly connected with many others by these threads. Such is the crude picture we may form of the structure of the mind and of the way the branches, twigs and leaves of the tree of logical knowledge are woven together by the threads of historical association." We must state that Professor McDougall attempts to vivify the spider's webs by the help of a conative structure superadded to the cognitive structure. But not all his disciples have seen the necessity of introducing into the diagram the essential mental activity without which it cannot work. One of his followers, apparently under the impression that the structure of the mind is but another name for the structure of the nerves, has provided a complete set of engrams or neurograms in the nervous system whereby every fact in the universe is mirrored in a corresponding nervous tract.[17]

This is to confuse a principle of explanation with a visual picture which enables us to grasp it more readily. Any picture of mental processes must be erroneous, and the figure of a tree is only helpful provided that we never forget that all the tissues are alive, the essential thing is the function of the parts and not the parts themselves Psychological dispositions are functional, not primarily structural, and the sole reason for their assumption is to explain, as far as may be,

the functioning of mind. If we omit the function the structure is perfectly useless. What we require to explain memory, habit, heredity, etc. is not a set of dispositions fixed in a nervous structure, but subliminal functions ready to be called into play when certain opposing conditions are removed. "The naturalistic attempt to account for function by structure, though it is old as Lucretius, has hitherto always broken down." [18]

(e) *The Configuration Theory*

We shall next consider a view of the structure of the mind called the configuration theory, which emphasises the primacy of form or order in all mental content in opposition to mental atomism or associationism. The name is translated out of the German word *Gestalt*, which means shape or form, and its derivative *Gestaltung* denotes configuration. In the sense here used a configuration is some arrangement which stands out against a background, like the pattern woven in a cloth The association doctrine assumed that a child gained experience by the passive reception of various elements or presentations such as sensations, images, movements, affects, etc. combined by association, and built into a structure by what was called apperception. Sensations and the other elementary presentations were the bricks, and association the mortar which cemented them together. Experimental psychology was pursued with the aid of elaborate instruments in the hope that the elements could be subdivided into smaller units. By making finer gradations of the stimulus, to which some response could be registered by means of instruments, it was thought that we could get nearer to the ultimate elements of conscious life. On the analogy of physical processes it was thought that the development of complex mental processes could be explained as the union of simpler ones. Over half a century ago James Ward

attacked this whole conception by insisting that mental development was an organic process, which could only be understood in terms of biological growth. An organism does not develop by the union of pre-existing units into more complex forms, and similarly the idea of mental units is untenable.

To avoid such error we must bear in mind that,[19] "At its first appearance in psychical life a new sensation or so-called elementary presentation is really only a partial modification of some pre-existing and persisting presentational whole, which thereby becomes more complex than it was before, and this increasing complexity and differentiation never gives rise to a plurality of discontinuous presentations." Instead of a chaos of disconnected ideas, subsequently reduced to order, a greater or less arrangement dominates conscious life from the beginning. Mental development is comparable to the discrimination of the separate notes within a chord; the rest of the chord being an undifferentiated volume of sound awaiting further analysis. As the analysis proceeds the chord gradually discloses its structure, and this may be regarded as the integrative part of the process. We may call the relation of the parts discriminated to the pre-existing and persisting presentational whole by the name of *configuration.* Each mental phenomenon is what it is only by virtue of its connection with some background, that is by its place as a member of some configuration; just as the notes of a melody are not isolated things but receive their colour and value from the melody as a whole.

The configuration or *gestalt* theory thus denies that mental events can be analysed into elements from which they are supposed to be formed.[20] It insists that a mental whole has qualities which cannot be discerned in the elements which are said to compose it. A painting or a melody has qualities, by virtue of its form which are in no sense present in any of the parts. You cannot find the melody in the notes,

any more than you can find the æsthetic quality of a picture by a scrutiny of the pigments. What is perceived in all such cases is a unique form-quality, arising from a complex interplay of relations, and existing only in the product as a dynamic whole.

A scientific foundation has been given to the theory by experimental work, such as that performed by Professor M. Wertheimer in his studies on apparent motion. In a cinema film a series of still pictures is projected at definite intervals on to the screen, whilst the projector cuts off the light as the film moves from one picture to the next. Thus no movement of any kind is produced on the screen, but merely a discrete series of still views, and yet it moves. A form-quality of movement is possessed by the whole experience of which the component parts bear no trace. Professor Wertheimer attacked this interesting problem by simplifying the conditions. He projected two vertical lines side by side, in succession, on to a screen, producing an experience of first one line and then another. By reducing the time-period between the exposures he arrived at an interval when an observer no longer saw two successive static lines, but a single line moving across the screen. Changes in the experimental conditions produced diverse movements. Thus, a horizontal line followed by a vertical, at a definite interval, gave a circular sort of motion. Professor Wertheimer and the supporters of the *gestalt* psychology endeavour to explain these results in terms of brain physiology. They assert that the brain action corresponding to the successive stationary stimuli is not discrete but continuous. At such short intervals the response of the brain fibres is a gradual merging from one state to the next owing to inertia. Thus the brain process is a moving one and the experience must, consequently, be one of motion. This is an instance of the firmly-rooted belief that we can only explain mental life by the assumption of

a one-to-one correspondence between mental events and brain events.

But it seems to me that we can dispense with this dogma. In some experiments by Mr. H. S. Langfeld [20] two parallel lines, with a dot between them, were exposed simultaneously. Shutters were placed before each eye, and opened and closed alternately, so as to expose the stimulus to each of the two eyes successively. A single line only was, under these conditions, perceived which moved backwards and forwards across the page, and a single dot moving in the opposite direction across this line Now this cuts out the idea that the movement could be the result of eye-movements, since the eye cannot move simultaneously in opposite directions. Again, under certain conditions, Langfeld obtained the impression of 'pure' movement, i.e. a feeling of movement without the perception of a moving object; as though the movement of an unseen object was perceived. In other words, the visual physical stimulus had no corresponding mental perception, whilst the mentally perceived movement had no corresponding physical stimulus. This is in direct contradiction with the one-to-one correspondence theory of brain and mind. The psychological fact which remains, after eliminating the physiological theory, is that an experienced situation is, in no sense, a sum of its parts, nor can it be resolved into them by analysis.

The whole idea of mental analysis appears to be unsound. Not only is it erroneous to regard an experienced whole as a sum of its parts, but the parts themselves get their significance only from their relation to the whole. If an artist were to draw a mouth of exactly the same shape and size in two different faces it would appear different in shape as well as in expression in each, for the character of the face diffuses itself over the separate features. Similarly, it is not possible to describe a person by enumerating and measuring his

various capacities, such as sensibility, memory, intelligence, etc. For a personality is an organised whole, not a sum of separate parts; and the description of each part misses the significance of the whole configuration, the interplay of dynamic relations.

A child's first experiences are not, as William James supposed a "big, blooming, buzzing confusion," but configuration of a primitive kind is evident from the start. The very first impressions are, as said above, modifications of some background against which they are perceived, and not isolated impressions springing out of the void. We do not start with a *tabula rasa* on which experience writes new characters, as the facts of mental heredity abundantly shew. Our earliest experiences are comparable to the discrimination of features in a distant landscape, out of which shapes gradually emerge against a vague background, as we attentively observe the scene. Instead of searching for the simple elements out of which the mental structure may be built up we must seek for processes by which mental development proceeds. Such processes are differentiation of experiences, retentiveness of such differences, and assimilation of new experiences by subjective activity. In these ways the vague background of experience gradually displays more and more complex configurations. It is a living process, and the growth of a living organism as shewn in the segregation and development of the fertilised ovum provides the nearest analogy to mental growth.

It is interesting to note that the hypothesis of the *gestalt* psychology, according to which all mental phenomena are figured or have a structure or pattern, is adequate to describe the law of association. No more than sensations come in isolation, but are always part of some larger background, do 'ideas' occur divorced from others but are always part of some definite context, by virtue of

which alone they have a significance or meaning. This meaningful context we may describe as the configuration or pattern of the ideas. As Professor Stout puts it, " In a continuous attention-process each successive presentation is apprehended in relation to the total object [the configuration] and the nature of this object is a most important factor in determining the flow of ideas." He might have said " the most important factor." [21] The problem of association is not to explain how ideas are associated, for they never existed otherwise than as part of some configuration. When, by attention to the relations, the nature of the configuration has once been grasped, the subsequent appearance of any part of the pattern serves to reinstate the whole. This simple formula is sufficiently comprehensive to include every distinct variety or mode of association. Thus 'association by contiguity,' as when the first line of a poem recalls the second, and so on, is an obvious case of completing a whole which is partially given. 'Association *by* similars,' as for instance the suggestion by a clear appearance of the sky of a frosty night, because in my past experience this has often happened, is a further instance of a partial configuration suggesting its completion. And finally 'association *of* similars,' instanced by a present thunder-storm reminding me of a previous storm, is in the same way the completion of a configuration by virtue of some of its features being presented anew.

The configuration theory thus swallows up what is true in the association theory, and incorporates what is valuable in the structure theory, namely that mental life is not a series of disconnected units, but is composed of patterns against a background, out of which more complicated patterns emerge as experience grows. But mental development implies more than this, and the additional process can be illustrated by considering biological development. While the fertilised ovum is developing, and the various organs

are being gradually segregated for different functions, the unity of function of the whole is still the essential feature of the process. The higher we ascend in the scale of life the more complex becomes the functions of the organs, and the more complete, therefore, their organisation if efficiency is to be secured. So, in mental development, it is not the complexity of the configurations which is the dominant fact, but rather their greater degree of organisation. A more highly developed mind implies one with a more complete organisation, i.e. in which the various powers may be duly co-ordinated to accomplish its purposes. Growth and development, from the psychological standpoint, implies fuller organisation. In later chapters we shall deal more at length with this concept of organisation as the criterion of mental development

Theories of the nature of mind, held consciously or unconsciously, especially the latter, affect our teaching methods It was at one time the custom to teach everything from "the elements," and text-books for pupils on the elements of grammar, of arithmetic, etc. were very popular. Reading was taught from the alphabet, followed by syllables, words and so on, drawing by the practice of delineating straight lines and simple curves, piano playing by five-finger exercises. Geometry was acquired from Euclid's elements, the definitions and axioms being learnt before the propositions. These elements were supposed to lay a sound foundation for the future superstructure. But the so-called elements are, in effect, the limits to which the separation of ideas from a vague background are tending. They arise at the end of the process of learning. A definition, for example, is a final stage and not a beginning Skill and knowledge are acquired by dealing with real, not abstract, situations. And these should be tackled from the start. Thus the earliest stages of a modern language should deal with simple actions accompanied

by their expression in the new tongue. Later on we may use bits of real dialogue fróm a gramophone record, or better still, from a sound film. We ought to bring an actual experience of a foreign situation to the learner in its living form. It is out of such a background that rules and vocabulary gradually emerge, and are subsequently fixed by constant practice. For words and grammar only have life in some concrete situation, and a feeling for language can no more arise from these in isolation than a knowledge of botany from the examination of dried specimens in a herbarium. The objection that is sometimes urged against such 'direct methods' that they do not cultivate accuracy, will be considered in the chapter on *mental discipline*. We must constantly remember that sound teaching ultimately rests on sound views of mental development.

There is one problem of development which we have left aside in describing the variety of theories but which can no longer be ignored. The individual mind is not a *tabula rasa* at the beginning of experience but shews traces of inherited experiences which, however, are by no means explicit but rather implicit. The extent and nature of this implicit native endowment will be considered in the next chapter.

CHAPTER II

MENTAL HEREDITY

Terminology—Evidence for Mental Heredity—Evidence from Twins—Effect of Environment—Inheritance of Acquired Characters—Inheritance of Moral Characteristics—What is Inherited?

THE TERMINOLOGY

THE idea of organic inheritance has been confused by the attempt to distinguish what is due to nature from what is due to nurture. Such a distinction, however, is erroneous and we must insist from the very start that the organism and its environment are a unity, which can only be separated in thought but not in reality. Amongst the host of difficulties encountered in the study of heredity not the least is that due to matters of terminology, and very little progress can be made until the meaning of terms is agreed upon. "Heredity," says Professor J. A Thomson,[1] "is mainly a convenient term for the genetic *relation* between successive generations." Much popular and indeed scientific discourse obscures this idea by the belief that there is a mysterious form of energy or, at all events, a driving force of heredity This is about as reasonable as the assumption that there must be a force of pupillarity urging students to a university because the relationship of the scholars towards their Alma Mater is expressed by the term *in statu pupillari*. Professor Thomson goes so far as to say that "All sociological talk that appeals to a 'principle,' 'law' or force of heredity should be ruled out of court."

Biologists call the stuff of living material bioplasm and they distinguish two kinds, the germ-plasm of the reproductive cells and the soma-plasm of the rest of the body. Obviously it is only the germ-plasm which is handed on from parents to offspring, or perhaps it is better to say that the germ-plasm is at the outset the offspring. It was at one time held that when the fertilised ovum began to segregate or divide some of the cells remained apart, relatively undifferentiated, and gave rise to the reproductive organs. The germ-plasm, in other words, passed on from generation to generation relatively unchanged. It was also believed that the soma-plasm remained distinct from the germ-plasm during the course of the individual life, but this idea is now abandoned by all competent biologists; and, in any case, there is no necessary connection between the continuity of the germ-plasm between successive generations and its assumed independence

The supposed separateness of germ-plasm and soma-plasm has served to perpetuate the notion that heredity is a *cause* or a *factor* producing certain results. But the term heredity simply refers to the fact of continuity and likeness between ascendants and descendants, due to their relationship. Had there been no sexual reproduction this misapprehension never would have arisen.

If we consider, for example, the case of a strawberry plant, the notion of heredity becomes much clearer. The plant produces numerous runners, and at intervals stalks appear above the soil with leaves and roots; and of course at this stage there is only one individual, since the bioplasm of the runners and the new shoots is continuous with that of the original clump. In the autumn the internodes of the runners die away and the clumps become independent, the process repeating itself continually, so that in each year new individuals are formed, which are descended from the first by continuity of

living substance. The formation of the new individuals is not a new fact, but merely a consequence of nutrition. Hence it is manifest that heredity is merely a name for the relationship of continuity and resemblance between individuals descended from each other. Continuity does not necessarily imply similarity, for the individual does not necessarily during growth always resemble himself exactly. This only happens when the growth takes place in identical conditions. If the climate, the soil, the food, or all of them, are changed the individual becomes modified; the farther the new shoot springs up from the parent stock the more it is apt to differ. Similarity, then, gives place to unlikeness and we no longer refer to heredity but to *variation*. When there are two parents the fact of continuity is still evident but there is a double likeness to be expected and consequently only a partial resemblance to each parent. We may, therefore, say that continuity with likeness constitutes the fact of heredity, but with the appearance of unlikeness we enter the domain of variation. The similarity of the hereditary relation in the lower organisms and man is suggested by the fact that such properties as curliness of the hair, colour and certain diseases of the eyes, certain facial characteristics, etc, in human beings seem to follow the Mendelian rules of inheritance.[2]

There is a fundamental distinction between physiological and psychological inheritance which is of the first importance. Unless this difference is carefully attended to nothing but confusion can arise from the study of mental heredity. In dealing with biological or physiological inheritance it is necessary to remember that we are making a separation where none exists in reality, for, as was pointed out above, at the outset the organism and its inheritance are one and the same. We can only consider them as two by an effort of abstraction, and the separation is attempted simply as a matter of convenience. All those likenesses which

can be traced to the parents or other ascendants are considered apart (although of course they do not exist apart) and referred to as hereditary characters. Now this is very different from the use of the terms when we refer to hereditary property, for in this case no difficulty is found in separating the individual from his inheritance in thought or in reality. The proper use of the term mental heredity should approximate the latter of these meanings and not the former if we wish to be intelligible But, as will be pointed out later, the analogy must not be pressed too far. In order to appreciate this, attention must be called to the varieties in the significance of the term *mind*, the meaning of which, like the spelling of Sam Weller's name, is a matter of taste and fancy. Mind may mean the living subject, the *ego* or soul itself; and in this sense the continuity that we previously referred to as constituting the fact of heredity in the physiological sense of the term, "so far from being an ascertained fact concerning this subject and any other subject, seems rather to be inconceivable even as a possibility."[3] Fortunately we are not called upon as psychologists to give any account of the origin of souls, or of their relation to each other. But the term *mind* may have a totally different meaning, a strictly psychological one with which the idea of mental heredity is bound up. It is highly probable that all heredity is ultimately psychological; and S. Butler in *Life and Habit* has given ample reasons for the belief that biological inheritance is a concept entirely devoid of significance unless we include in its connotation the idea of mental heredity. Use and habit were for him the key to the understanding of heredity, and since function determines structure, not *vice versa*, it is clear that psychological factors take the precedence.

The second use of the term *mind* to which I have referred is that in which it is employed as equivalent to the *objective* side of experience, i.e. the *presentational continuum* of James Ward. Experience or behaviour has two sides, a subjective

activity and the objects attended to, namely, the presentations. With regard to such mental objects we find that " what we call a presentation is still part of a larger whole. It is not separated from other presentations whether simultaneous or successive, by something which is not of the nature of a presentation, as one island is separated from another by the intervening sea . . . we are led alike by particular facts and general considerations to the conception of a *totum objectivum* or objective continuum, which is gradually differentiated." The differentiation and growing complexity of this presentational continuum is what mainly concerns the psychologist and is exemplified, let us say, in the overtones which the musician distinguishes but which the non-musical person does not hear. The musical person's note has parts and relations which are absent from the other's. Now it is conformable with a good terminology to refer to this continuum, which the individual deals with, as his mind. We may, owing to its intimate relation with the bioplasm, call it ' mental tissue.' The subject is said to have a mental inheritance because his ' mind ' or mental tissue, like his body or bioplasm may shew, as it develops marked affinities with that of his parents. In other words, what is inherited psychologically is not a soul or psyche but mental tissue, which is continuous from generation to generation. Native endowments which are usually referred to mental tissue are untaught propensities, untaught in the sense that the person's interest in these directions requires no prompting from others but compels him, as it were, to make himself efficient by practice in certain directions as in the case of Darwin who began to collect insects when a schoolboy.

There is a useful distinction, frequently overlooked, between the terms innate and inherited. Any inborn modifications in the mental tissue, if they exist, which lead to certain responses would be rightly called inherited. But there is no reason to

think that genius though inborn is inherited; and whereas ability is said to be native or acquired, genius being a matter of creativeness or originality can never be acquired. We ought, however, to speak of it as innate, as all our knowledge goes to shew that it is inborn and must be the peculiar property of the subject or *ego* as opposed to the mental tissue. It is not what he inherits which makes the genius but what he makes of his inheritance

It was pointed out above that to speak of the individual without reference to his environment is to talk of an abstraction, for the terms are correlative implying each other. Rousseau blundered badly when he suggested that Émile should be educated apart from a social environment. There is no such thing as a human being apart from a social *milieu*. The relation between the two has been admirably expressed by Sigwart,[4] who says. "If we call to mind how little on the average each of us acquires by himself alone and independently of others, how much of what he knows and believes is common property, one almost gets the impression that any distinctive individuality we possess really belongs only to our bodies, not to our minds. As for the ideas and thoughts that animate us, they seem like the breath our lungs inhale, drawn from a common atmosphere and returned to it again." The environment alone, however, will not fully account for human differences any more than the climate and soil of a region will wholly explain the diversities of the plants within it. Nevertheless, the environment is of fundamental importance in heredity, for it may easily happen that an inherited characteristic fails to show itself owing to the absence of the proper environmental stimulus. Thus there is a wan newt called Proteus in the dark streams of Dalmatian caves that has no pigment in its skin, but we should err if we hastily concluded that the factor for pigmentation is absent. If Proteus is removed from the caves to daylight it first becomes spotty and then dark. If

it produce young in the new environment they too are dark, and the eyes which are very degenerate in the cave attain to a greater degree of development. We may also call to mind that Plato's cave-dwellers could not attain to a knowledge of the good until they were dragged into the light of day. So, many a schoolboy acquires a reputation for incompetence because the environment or the teaching being unsatisfactory his native powers are dormant, as there is no adequate stimulus to bring them into play.

EVIDENCE FOR MENTAL HEREDITY

Now that our terminological difficulties are partially solved it is time to consider the evidence that has accumulated bearing on the inheritance of ability. The first worker in this field was Francis Galton who, in 1869, published a book with the title *Hereditary Genius*. By the time he had corrected the edition of 1892 he had seen the error of his ways and explained that the original title was an obvious misnomer for the more modest *Hereditary Ability*, since he did not use the word genius in its usual sense, but merely as expressing an ability that was exceptionally high, and at the same time inborn. He pointed out that the distribution of faculties in a population could not possibly remain constant if, on the average, the children too closely resembled their parents. If they did so, physical or mental giants would become more gigantic and dwarfs more diminutive in successive generations. Since this does not, as a matter of fact, occur it is manifest that the filial average is not the same as the parental, but nearer to mediocrity, i.e. it *regresses* towards the racial mean In any stable community there is a typical centre from which individual variations occur in accordance with the 'normal' curve of frequency. "The filial centre falls back farther towards

mediocrity in a constant proportion to the distance to which the parental centre has deviated from it." The technical term *variation* ought always to be used to express changes of this kind from the racial mean. As a result of his investigations Galton concluded that the hereditary relationship is similar both as regards biological and psychological characteristics, and also that it would be quite practicable to produce a highly-gifted race of men by judicious marriages during consecutive generations.

His method consisted in the careful examination of the relationships of over three hundred families containing between them about a thousand 'eminent' men, regarding eminence as shown by high reputation as "a pretty accurate test of high ability." The eminent men were judges, statesmen, literary men, scientists, artists, etc. He found that there were enormous odds in favour of a near kinsman of an eminent man having ability of a high order as compared with one more remotely related. Eminent sons were more numerous than eminent brothers and there was a sudden dropping off at the second degree of kinship, namely grandfathers, grandsons, uncles, etc., whilst at the third degree of kinship there was a further dropping off. In this way he demonstrated an increase of ability in the generations that precede its culmination to eminence and a decrease in those that succeed.

Galton's work was taken up by Professor Karl Pearson [5] who likewise adopted the method of collecting family data. He elaborated and refined the statistical method of dealing with the facts and invented new modes for calculating degrees of resemblance. By the year 1904 he had collected nearly four thousand schedules referring to certain mental, moral and physical traits of brothers and sisters between the ages of ten and fourteen attending a large variety of schools all over the country from Aberdeen to Yeovil. The physical characters were such things as stature, length of arm, cephalic

index, eye-colour, etc, the mental characters were estimates of intelligence formed by the teachers on the basis of a sixfold graduated scale of ability, and the moral traits referred to such characteristics as vivacity, self-assertion, conscientiousness, good nature, temper, and so forth. It ought to be remarked at this point that the statistical treatment of estimates of intelligence or moral qualities, however accurate, can never produce a finer scale than the rough one that we start with That is, we can never get more out of the figures than we put into them, and it is necessary to state this truism since some investigators perform the most elaborate calculations on the very roughest data. It is absurd to calculate degrees of resemblance to three decimal places when the data are only quantitative, as it were, by courtesy. For this reason in what follows I have not hesitated to eliminate the end figures freely

Professor Pearson's argument is based on the following proposition. If fraternal resemblances for the mental and moral characters be greater than, equal to, or less than fraternal resemblances for the physical characters, then parental inheritance for the former set of characters is greater than, equal to, or less than that for the latter set. An idea of the degree of resemblance may be obtained by considering the slope of the regression line or the degree of correlation For the physical characters, such as cephalic index, he found that the slope of the line of regression was about ·50, whereas the slope of the line for estimated intelligence or ability was ·47.

The following table shews the value of some of the correlations that were calculated from his data.

	Brothers.	*Sisters*	*Brother-Sister*
Head length .	·50	·43	·46
Eye colour .	·54	·52	53
Intelligence .	·52	·50	·49

Further, it was estimated that the correlations between the siblings was approximately of the same value for physical

characters as for qualities such as vivacity, conscientiousness, self-assertiveness, etc. Hence, in accordance with the above stated proposition Professor Pearson inferred that "the physical and psychical characters in man are inherited within broad lines in the same manner and with the same intensity." But this statistical deduction was accompanied by the highly doubtful opinion that "the average home environment, the average parental influence is in itself part of the heritage of the stock and not an extraneous and additional factor emphasising the resemblance between children from the same home." However that may be, it would appear that, if these results are trustworthy, they suggest that whilst mental and moral qualities may be fostered by good environment in the home and the school they emanate from parental nature rather than nurture, they are bred in the bone.

The investigations of Professor Pearson's pupils on adults have, on the whole, confirmed his results for school children.[6] By consulting the *Oxford Historical Register* it was possible to compare the classes in the B.A. degrees taken by all the men between the years 1830 and 1892 whose fathers had also been at Oxford. It was found that the number of sons who took high honours fell off steadily according to the degree taken by the fathers. If a father wants his son to take a good degree he had better do so himself, as the table shews. Heredity is better than precept in the matter of degrees.

Degree taken by Fathers.	*Percentage of Sons taking 1st and 2nd Class Honours.*
1st and 2nd Class Honours	27
3rd Class Honours	15
Pass Degree	12
No Degree	9

The results are equally instructive if we take the sons' degrees as the standard and compare the relative percentages of fathers who took high honours. The diagram printed on the next page shews that the percentage of fathers who obtained high honours

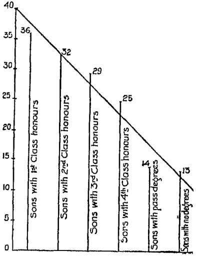
(1st and 2nd Class) diminish regularly, i.e. in a straight line, as we pass through the various grades of sons. On the basis of all the figures it was shewn that, if unity is taken to represent perfect resemblance and zero complete lack of similarity, "the degree of intellectual similarity between father and son, as indicated by the degrees which each took is ·3." [7] It is very hazardous to indulge in speculations where statistics and examination results are jointly concerned; but if we choose to give rein to our fancy and assume that a student's mother and father contribute equal amounts to his mental endow-

INHERITANCE OF ABILITY
(*After Schuster and Elderton*)

Total number of Sons 2,459

Date of Degrees of Sons 1860–1892

The heights of the vertical lines shew in what percentage of cases the fathers have taken either first or second class honours. The diagram shews that the percentage of fathers who obtained this degree of distinction diminishes with some regularity, as one passes downwards from the sons with first class honours to those with no degrees



ment, we may say that the mental tissue which he inherits is responsible for two-thirds of his ability. When the degrees of brothers were compared it appeared that of the first class men, 45·5 per cent had brothers who took high honours, of the second class 38 per cent of brothers took high honours and the percentage steadily diminished as one passed down the scale of degrees.

Exception may be taken to the results just considered on the ground that the estimation of ability by examination

results, or by a crude scale, is unsatisfactory. More recently mental tests have been employed for the purpose. With the aid of the Binet-Stanford tests the intelligence-quotient or mental ratio of two hundred pairs of brothers and sisters in orphanages in California was estimated The coefficient of correlation between these siblings turned out to be ·54, which is in close agreement with the results previously obtained

EVIDENCE FROM TWINS

The evidence, so far considered, strongly suggests that intelligence is a capacity that somehow depends for its manifestation on the hereditary relationship. If it could be shewn that the nearer the relationship the higher the degree of resemblance in intelligence, the proof would be greatly strengthened. Now the closest biological relationship is that found between twins, of whom there are two kinds, identical and fraternal. The former are derived from a single ovum whilst fraternal twins, being derived from separate ova, are really ordinary brothers and sisters who happen to have been born at the same hour Identical twins are almost exact duplicates of each other in physical traits, such as cephalic index, height, eye-colour, etc., and more especially they are of the same sex. Fraternal twins may be of the same sex, but identical twins must be. If we wish to secure a group of identical twins, they will be found in a collection of twins of like sex.

Now, if intelligence is inherited, the study of twins ought to yield the following evidence. All twins, but more especially those of like sex, ought to have a degree of correlation of intelligence higher than ordinary brothers and sisters. Since twins are nearly always subjected to the same influences, if the environment is the essential factor in producing resem-

blances, older twins ought to be more highly correlated in capacity than younger ones. And further, on the same assumption, older twins ought to resemble one another more closely in such things as are much influenced by the environment, namely school studies, than in general intelligence, which is presumedly inborn.

In order to test these assumptions, various studies in twin resemblances have been undertaken. Over a hundred pairs of twins were examined by Mr C. Merriman [8] by means of intelligence tests. He found that their intelligence quotients were more highly correlated than those of ordinary siblings, and that those of like sex were still more highly correlated. He also demonstrated that the degree of correlation was not higher for older twins than younger; and thence concluded that the environment makes no significant difference to the degree of resemblance in intelligence which he had found.

A further investigation was undertaken by Mr. C. E. Lauterbach,[9] who examined over two hundred twin-pairs, ranging in age from seven and a half to twenty years. In addition to intelligence tests of different kinds, he gave them certain standardised tests of memory, reading, arithmetic and writing; and made physical measurements of height, weight, and cephalic index. For the combined physical traits he found the following results, in which the figures are average correlation coefficients: like sex ·78, unlike sex ·55; younger ·63, older ·62. Age, therefore, has no influence on the degree of physical resemblance, which seems to be established very early in life. But the mental resemblances are what interest us mainly. When he compared the twins of like sex with those of opposite sex he found that the former were correlated higher in general intelligence and in school subjects than the latter; which suggests that identical twins have greater intellectual affinities. No significant statistical

difference was found between younger twins (ages seven and a half to thirteen years) and older ones (ages thirteen years to twenty), in the combined results of the intelligence and scholastic tests. If we separate out the scholastic tests, which are more likely to shew the predominance of training, from the intelligence tests a most important fact emerges. "One might expect greater similarities in reading, arithmetic and writing, which are abilities subject to training, but such similarities do not materialise except in reading" These results indicate that the differences which are found to exist between these individuals are due to the hereditary relationship, and cannot be smoothed out by training, as similar environments have little influence in making people resemble one another more closely than they did at the start.

A recent investigation has been made by Dr A. H. Wingfield [10] of Toronto, who used more accurate statistical methods, and made due allowances in his calculations for differences solely due to intellectual maturity. Different age groups exhibit different ranges of variability, i.e. as persons become older they may tend to diverge more in their mental capacities; a complication which statistical theory can deal with. When older and younger twins are compared this difference of range within each age must be allowed for, before deductions can be drawn between the ages. Dr Wingfield examined just over one hundred pairs of twins with an age range from about eight to fifteen years, by giving them a couple of tests of intelligence and a variety of standardised scholastic tests. From these data he was able to calculate the intelligence quotient and the educational quotient (i.e. the ratio of educational age to chronological age). When the results from both these sources were combined he found an average correlation coefficient of ·78 for twins from eight to eleven years, and ·79 for those from twelve to fifteen years. Whence he concluded that the

younger and older children are precisely alike in native and acquired capacities combined. They appear to be developing along lines determined by the hereditary relationship, which school training seems powerless to modify to any appreciable degree. By comparing the results of the intelligence tests with the educational tests he found that the difference between the correlation coefficients was insignificant, namely, ·76 for intelligence quotients and ·75 for educational quotients. This implies that the degree of resemblance between the twins in intelligence and in school work respectively, in so far as these are separable, is the same. They are no more different in capacities which are largely the result of nurture than in those mainly due to nature. Like the previous investigators, Dr Wingfield demonstrated that there was a greater degree of intellectual resemblance between twins of like sex than those of opposite sex, and a still higher degree between identical than fraternal twins, when the former were carefully selected on the grounds of indistinguishable physical characteristics. From his own investigations and those of his predecessors he compiled a table of correlations, which shews that the degree of resemblance in intelligence is closely related to the degree of hereditary kinship. The correlation coefficients are as follows. identical twins ·90, like-sex twins ·82, fraternal twins ·70 (these include all the unlike sex pairs and those of like sex not physically identical), unlike sex ·59, siblings ·50, parent and child ·31, cousins ·27, grandparent and grandchild ·15.

A further inquiry has been made into the resemblances of twins in which the distinguishing feature was the careful selection of the cases to be examined. Mr N. D M. Hirsch [11] dealt with twins of the same sex and selected some on the basis of similarity in appearance, gait, voice, expression, temperament, school work, and general intelligence ; all these being judged by teachers and others intimately acquainted

with them. He also selected cases which were dissimilar. By this means he got three groups of twins, each pair being of like sex; similars or like pairs brought up together (38 pairs), dissimilars or unlike pairs brought up together (54 pairs), and similars brought up apart (5 pairs). It will be realised that it is difficult to find examples of the third group, and the actual numbers are, of course, statistically insignificant. Many of the observations were of a non-quantitative kind and referred to such things as emotionality, activity in games, temperament, disease history, etc. These considerations are difficult to classify and cannot be considered here, but carry conviction when presented in detail and support the quantitative results. Various mental tests were given to each individual, and physical measurements, such as cephalic index, were taken.

We may classify the results in a twofold way: first, by comparing similar with dissimilar twin-pairs in the same environment, i.e. brought up together, and, secondly, by a comparison of similar twin-pairs in the same and in different environments. For the former comparison, the mean *difference* in intelligence quotient scores for the unlike twins was 13·8, for the like twins 2·3. It is thus seen that despite the fact of a common environment, fraternal twins differ much more in intelligence than do identical twins. For the identical twins the mean difference in intelligence quotient scores of those in the same environment was 2·3, and of those in different environments 3·5. The number of cases for this latter comparison, as was said above, is too small to justify any statistical deduction, yet the qualitative comparisons showed that identical twins do tend to be identical in a variety of traits, although they are brought up apart. This latter fact had long ago been noted by Galton, not only with respect to intelligence, but to temperamental and other traits of character.

It must be remembered that the conclusions we have so far established are statistical, and it would be over-hasty to infer that the effect of the environment is not important. We turn to the consideration of this difficult topic, which is of prime importance both in the theory of education and educational administration.

EFFECT OF ENVIRONMENT

It was stated in an earlier section of this chapter, that without the stimulus provided by a favourable environment, native abilities could not develop. Thus a person's lung capacity, like his height, is no doubt determined by his hereditary relationship, but if he works in a cramped position without proper ventilation, his vital capacity will be seriously affected. Not only is a suitable environment essential in order that abilities may function, but without it we should have no means of knowing what the latent capabilities are From the evidence we have so far considered, it appears that whilst education cannot increase what we may call the vertical dimension of intelligence, yet the horizontal dimension, or the extent and variety of what a pupil acquires, is entirely a matter of suitable educational opportunity. The same is true of physical growth ; for whilst it is possible to stunt the stature of a developing child by deprivation of the essential foods, sunlight, etc., it is not possible to force up the final adult stature by the best environment beyond the limits laid down by genetic possibilities. Heredity and environment both contribute to intellectual growth, but the role of the latter is developmental, not creative. An interesting confirmation of this was found by examining the school marks of pupils, term by term, over a period of years. The variability for later terms was greater than that for earlier

owing to the fact that pupils below the average fall off with time, and those above improve. Education in the same environment seems to accentuate individual differences. So much so that it was half-seriously suggested that the best way of choosing pupils for higher education was to select brothers and sisters of those who had already made a success of it; rather than by examination.[12] It is evident that the importance of the environment in developing latent powers increases as we ascend in the scale of intelligence. At all events, that is what was suggested to Mr N. D. M. Hirsch by his researches on twins. This seems reasonable enough; for a higher degree of a particular capacity needs a richer environment in order to get adequate stimulus. However that may be, no ability can come to fruition without a suitable environment.

Modern psychology is nothing if not statistical; and attempts have been made to estimate the effects of school and home environment in promoting intellectual development. Miss E. M. Lawrence [13] investigated children in various institutions by means of intelligence tests, and compared them with those brought up at home who attended a typical elementary school. One of the institutions was a home for illegitimate children who had never seen their fathers, and had lived with their mothers for not longer than one year, the average being six months. Wherever possible the father's occupation was discovered, and classified into one of five grades, A to E, ranging from professional to dock labourers, with intermediate grades for different kinds of skilled and unskilled labour. By comparing these grades with the results of the intelligence tests on the children it is possible to find a correlation ratio between them. Some of the figures obtained for the institution children did not seem to differ significantly from those for the children from the ordinary school. Thus, for the elementary school the

correlation ratio for the father's occupation and the child's intelligence quotient was: boys ·27, girls ·22, the corresponding figures for the other children were ·26 and 25 respectively.[14] A caution of a general kind must be given here, not to place too implicit reliance on statistical results; for two similar ratios may conceal sets of observations which differ considerably. And, in actual fact, when the results were sorted statistically in other ways, the same clear-cut resemblance was not evident. Yet, by every method of sorting the results, some correlation was obtained between the parent's class and the child's intelligence. "What finally emerged from this work is that though a child has never lived with its parents, it is likely, other things being equal, to have a slightly higher intelligence if it comes from one of the so-called upper classes, than if it is the child of labouring people." Once again, despite repetition, it must be insisted that this is a statistical inference, and should not be applied to individuals. For the investigator picked out all the children with a very high intelligence quotient above 135, namely fourteen, and all those with very low intelligence below 70, namely twenty-eight. The surprising result was found that the fathers of the children of the brighter group in no case belonged to the A grade, and only two or three to B, all the rest came from grades C and D. The occupations of the fathers of the dull and deficient children were likewise all of the C and D grades.

There is a further comparison that can be made to discover the effects of the environment. If the environment can influence intelligence scores, we should expect that children reared in the uniform environment of an institution to resemble one another more than those brought up in dissimilar surroundings at home. By comparing the deviations from the average result in any group of persons with the average itself we may arrive at a coefficient of variability;

which shews the extent of variation within the group. For the institution children the coefficient turned out to be: boys 13·93, girls 12·94; for the children in the elementary school, boys 15·39, girls 14·04. "These increases are very small, and are statistically barely significant. They are in the direction one would expect, but are certainly smaller than might be assumed, considering the very great uniformity of environment in the institution."

The conclusions that are indicated by this study of the effects of the environment are rather complicated. What is clear, however, is that there is an association between the intelligence of the parents, as presumed from the grade of their employment, and that of the children "The association is on the whole rather smaller, however, in the case of institution children, and there is little doubt that environmental conditions have some weight in influencing the response to the tests" Miss Lawrence examined children in other institutions, where they were admitted at varying ages, and her conclusion is very interesting. "The decrease in correlation between the child's intelligence and its social class among children taken away from home at an early age, as compared with those in the same institutions who left home later, and the increasing correlation between intelligence and class with increase of age, for children remaining at home, both suggest that environment has to some extent influenced the test results." We shall return to the consideration of the environment when dealing with moral characteristics. In the meantime it is important to realise that, if a system of education is to be maximally effective, it must provide a sufficient variety of environment in different categories of schools, in order to give appropriate stimulus to different grades of intellectual capacity.

THE INHERITANCE OF ACQUIRED CHARACTERS

We must next consider briefly a problem of heredity which has given rise to infinite discussion and a large amount of experimental biology. Much of the discussion is vitiated by a loose use of terms, as biologists are not skilled in dialectics and very little of the experimental work has any bearing on the problem of mental heredity, which is the only side of the case that interests us. The question at issue is whether parents' habits have any influence in making easier the formation of similar habits in the offspring. Can parental nurture so affect the mental tissue that the children find themselves in possession of a mental endowment varying in the same direction ? Or to use Biblical phraseology : when the fathers have eaten sour grapes are the children's teeth set on edge ? Lamarck believed that a new environment which an animal encounters, requiring new modes of activity to secure proper adaptation, leads to the modification of its organs, and if the activities are repeated for a sufficient length of time modified organs will be transmitted to the descendants Weismann denied this possibility mainly on the erroneous ground that the germ-plasm was physiologically distinct from the soma-plasm, and therefore he could not conceive how the modification could be transmitted.

A large amount of biological evidence in favour of the transmission of acquired characters has been accumulated, but is chiefly concerned with changes in colour or in the form of organs.[15] Thus if salamander *maculosa*, which has a black colour spotted with patches of yellow, is allowed to pass its life on a background of yellow loam the patches of yellow increase in size. If the offspring are treated similarly the whole surface of the skin becomes yellow with the exception of a few streaks of black. Changes in the opposite direction

towards black can be produced by a black environment in a couple of generations, so that the offspring resemble in colour a different species, salamander *atra*. The changes in colour which are induced by the environment are undoubtedly due to the genes in the cells, i e. they are genetically present, but their action is masked in some way ; just as recessive characters are masked by dominant ones. What the environment does is to provide some stimulus making the changes possible. These results are therefore of value as shewing that there is no inherent impossibility in the supposition that an induced change may give the offspring a tilt in the new direction, enabling it to display characters which had no chance before ; so that one may approach the question of the mental heredity of acquired characters with an open mind. Evidence tending in the same direction has been obtained by examining the carefully-kept records of English trotting horses which show a gradually improving time for the mile from generation to generation. But, of course, it is possible that the training has improved and that such influence of the environment acts separately on each successive generation.

Passing to human beings it is frequently stated that the Australians and the Americans have produced a new human type and that the descendants of the immigrants have lost their distinctive European characteristics. But such observations are largely subjective, and the so-called new types are probably due to the imitation of parents by the children and the continuous influence of a novel environment. There is little doubt that environmental influences may work profound changes in a relatively short time, so that, without inheritance, what appears like a new type may be bred. The head master of Christ's Hospital has assured me that within a couple of years at school the elementary scholarship boys are indistinguishable from the others in speech and manner, and that the rapidity of these acquirements varies

directly as their intellectual ability. The environment in this particular case is especially favourable, since the boys live in the country, far removed from disturbing parental factors and are all clothed in the same costume and live the same life. Again the Parsees of Bombay have lived in India for several centuries, and during the whole of this time have adopted the native Gujerati language, but their speech sounds still shew very decided phonetic resemblances with the Persian tongue, possibly owing to the fact that they congregate together and thus maintain an isolated social environment

All such indirect evidence, though highly suggestive, can never produce complete conviction Fortunately there is at our disposal a means of direct experimental research which promises to throw considerable light on the problem Now, in order to devise and interpret any experiment in psychology, or indeed in any other science, it is necessary to have clear ideas of what we are looking for. What, then, ought we to expect from experimental work in this connection ?

When we consider the countless generations that have elapsed before civilisation took its present form we are helped to realise the difficulty of making any modification in the preexisting physical or mental endowment. To use a happy illustration devised by Professor J. H. Robinson [16] imagine the whole of our present status to have been attained in a single lifetime. Suppose, in other words, that a single generation of men, in a state of complete uncivilisation, had by their own efforts in fifty years attained to the standard of present-day civilisation which it has taken the race, say, half a million years to acquire. Only late in the forty-ninth year would they have given up wandering and settled down to agriculture. Half-way through the fiftieth year they would have invented writing ; the printing-press would be about a fortnight old and the steam-engine would have been invented about a week ago. In the light of this chronology it is preposterous to

suppose that any biological experiment can straightway impose a new characteristic fully equipped like Athena issuing from the head of Zeus. All that we can reasonably expect is that the offspring should shew some slight trace of increased facility in acquiring a modification initiated by their progenitors, and that this will be lost unless adequate opportunity is given for exercising it.

Now the ability to bestow meaning on spoken sounds is undoubtedly an acquired character, and children brought up in a new environment shew remarkable facility in this respect. For instance, English children of three or four years of age, in India, speak one or more different dialects to different Indian servants and English to their parents; whilst their parents learn one dialect with considerable difficulty.[17] Such cases, which are frequent, can only be satisfactorily explained on the hypothesis that the child intuitively and subconsciously places the correct meanings on the various sounds. He has inherited the propensity and displays it when opportunity for practice is given. Every child, of course, shows the same facility in picking up his own language, only we are so used to it that we cease to wonder at the marvellous power displayed.

Turning now to the experimental results, we are indebted to Professor McDougall [18] for investigations carried out to test the Lamarckian hypothesis. He experimented with white rats and bred several litters from which he selected, at random, one-half of the offspring, making two equivalent half-stocks which were subsequently inbred. One half-stock was trained for several generations successively to form a habit, and the other was used as a control group. The training consisted in placing the rats in a tank of water from which there were two ways of escape by means of gangways. Either gangway could be illuminated, but if the rat tried to get out by the illuminated path he received an electric shock.

And during the course of the training even the stupidest rat learned to escape by the dark gangway, which was sometimes to the right and sometimes to the left. The training went on for twenty-three generations, during the last ten of which every rat was trained to the point at which he made no errors. Professor McDougall observed that there was a critical stage of learning in which each animal has to graduate before he becomes an expert performer. For the transmission of the acquired habit the training prior to this critical stage is of little importance. "Lamarckian transmission is a function of the achievement of the critical stage of learning" Possibly this is the stage at which the animal no longer learns by the effect of punishment but by insight into the meaning of the situation, which the configuration theory maintains is the only way of learning.

The average number of errors for all the rats of the first generation before they could acquire the habit was 150, whereas for the twenty-third generation it was 25 The three best rats of the trained last generation made only 3 errors each, whilst the best rat of the control stock made 90 blunders. These were the most favourable records selected out of a mass of others; but the general results convinced Professor McDougall that the increased facility, on the whole, through the generations, was due to inheritance Of course he did not expect a transmission of the habit itself, though that is the kind of thing that popular biology anticipates in experiments of this kind But even the slightest increase in facility of learning, if it were well established, would be sufficient. It must be remembered that twenty-three generations of trained rats would represent about seven centuries in terms of human life. Yet the results of this experiment are far in excess of what might reasonably have been anticipated in such a period, in the light of our previous considerations. Accordingly they have been challenged [10] both on the

statistical basis, that not enough animals were employed, and on general grounds. The control group had different tasks to learn, and this handicapped them in acquiring a new habit, for two habits may interfere with each other Again, tameness increases from generation to generation owing to the acquired facility of the experimenter in handling the animals, which induces less and less fear in them. Rats get used to certain ways of handling, and very minute differences in treatment may produce a nervous state. As the control groups were treated differently and handled by different persons this may have affected the results. Nevertheless, the method adopted by Professor McDougall is the only sound psychological method of approach to this difficult and important problem.

The case for the inheritance of acquired characters is not, however, of fundamental importance for human beings. Man is, in this respect, in a peculiarly favoured position, for even if it is not certain that changes in the individual mental tissue are transmissible, yet he has an external heritage of tradition and convention, customs and institutions, literature and the sciences. Civilised society is itself a heritage of ideas and ideals which we inherit by being born into it. Changes in it are part of man's inheritance. Every pupil who enters a school with a good tone and long established traditions, or even new traditions if they are active, is in the position to inherit these. We may compare the *esprit de corps* of a given institution, such as a school, with the mental tissue since it is the means by which tradition is handed on. When a great school master like Thring or Sanderson promotes or induces variations in tradition these, in favourable circumstances, become the changed inheritance of many succeeding generations.

INHERITANCE OF MORAL CHARACTERISTICS

So far we have dealt with intellectual inheritance, but the question may be raised whether our conclusions apply to moral characteristics. Is the tendency to delinquency inherited in the same sense in which the tendency to acquire intellectual power is hereditary? This important question has been thoroughly investigated by Dr Cyril Burt,[20] whose statistical treatment is illuminated by a sympathetic insight into individuals. He examined, in detail, two hundred juvenile delinquents between the ages of seven to eighteen years, and compared them with four hundred non-delinquents of the same age, of the same social class, living in the same streets and attending the same schools. Every relevant feature *in each child's family* was catalogued; every characteristic that is to say, which might be supposed to be hereditary and at the same time to have disposed the delinquent towards the commission of his offence. These characteristics were classified into four main groups—physical, intellectual, psychopathic, and moral. The physical conditions included such illnesses as epilepsy, chorea, etc., whilst the intellectual conditions included mental deficiency, extreme backwardness which might be thought due to congenital causes, etc. The third group consisted of temperamental conditions involving pathological symptoms, such as insanity, various emotional disturbances and so forth. The fourth also embraced temperamental disturbances marked by moral symptoms, such as suicide, alcoholism, sexual irregularities, cruelty, etc. These were the main conditions or defects occurring among the relatives of the delinquents which have been regarded at some time or other as hereditary and predisposing to criminal tendencies.

If a table is drawn up of the relative frequencies with which these presumedly hereditary defects occur, both among

the families of delinquent and of non-delinquent children respectively, we can calculate a coefficient of association. Such a coefficient indicates the degree of correspondence between offences in the children and the supposedly hereditary defects in their families. The coefficient, like the coefficient of correlation, is a fraction lying between zero which denotes complete lack of association, and unity which means perfect correlation. For the four groups of defects enumerated above the coefficients were: physical ·17, intellectual ·34, temperamental with pathological symptoms ·24, and temperamental with moral symptoms ·41. The conclusion that Professor Burt drew from these figures is that the number of delinquent children who might be presumed to have criminal blood in their veins is comparatively trifling. He thinks that other causes for delinquency can be found whose removal is often followed by complete reform. "Many of these provocative factors—bad companions, bad neighbourhood, bad discipline, and a bad example at home—are a by-product of the moral laxity of the parents, the degeneracy of the family thus operating indirectly through the resulting environment, instead of directly by its influence on the germ-cells."

The influence of the environment was estimated by a statistical comparison with the control group which, as was stated before, lived in exactly the same surroundings. The various factors operating in the home were considered, namely poverty, defective family relationships, vicious homes and defective discipline. Those operating outside the home which were studied were companionship, the conditions of the child's work in school or in his occupation, and those connected with his leisure, such as the cinema and opportunities for games, etc. The coefficients of association for these environmental factors are very suggestive: poverty ·15, defective family relationships ·33, defective discipline ·55, vicious homes ·39, influences outside the home ·29. The figure for defective

discipline, which is considerably higher than that for any other group of factors, either in the environment or in the family history, is the most outstanding result of this investigation. If we compare the two sets of coefficients given above, those for intellectual and moral defects in the child's relations shew a suspicious approach to the figures for vicious homes and defective discipline, defective discipline in this connection means either no discipline, or what is too strict or too lenient, or more often a mixture of complete licence alternating with undue severity. The suggestion is almost inevitable, that the delinquent may be suffering quite as much from the vice and mismanagement of the home by dull or immoral parents as from any inherited mental dullness or immorality Inevitable, that is to say, statistically, for it is unjustifiable to apply a numerical result to an individual case Destiny, according to modern science, deals with groups, not individuals; and even the group's fate is a matter of probabilities. Nevertheless, as Dr Burt studied intensively, not only his figures, but all his individuals, his conclusion must be accepted. "Of all environmental conditions, indeed of all conditions whatever that find a place in my list of causes, the group shewing the closest connection with crime consists of those that may be summed up under the heading of defective discipline. Such features are encountered five times as often with delinquent as with non-delinquent children"

It is to the moral atmosphere of the home and neighbourhood, those influences which affect the family life, that we must look for the chief causes of criminality or anti-social behaviour. Yet we cannot regard the result as foredoomed, for the environment and the individual, as we have so often insisted, are mutually interacting. It is a mere abstraction to consider the home or any other part of the environment apart from the individual. For a person is not like a photographic plate on which the environment makes an impression

which is passively received and reproduced. As Dr Burt has pertinently said, "Some natures remain unsoiled though sunk for years in mud: others are porous and penetrable; and the grime works into the grain. It is the personal reaction to a given situation that makes a man a criminal, not the situation itself. It is not bad surroundings that create delinquency, but the workings of these bad surroundings on the thoughts and feelings of a susceptible mind . . . inner personal weaknesses which give to these outer environmental factors their power to work their worst."

Enough has been said with regard to moral characteristics to justify the belief that for morals, just as for intelligence, the antithesis of heredity and environment is not clear cut. All that we can do is to estimate the relative effect of prenatal and post-natal influences. In the present investigation congenital factors were recorded among delinquents rather more than three times as often as among non-delinquents; whilst environmental factors occurred rather less than three times as often. In well over one-third of all the cases, but in rather less than one-half, there was reason to suspect some deep congenital defect as the major cause of wrong-doing. Thus the share of inborn constitution in the production of juvenile delinquency cannot be ignored. "But it would be a gross distortion—a mistake too commonly deduced from current fatalistic theories—to paint every criminal as the helpless victim of his inborn nature." For there remain still a majority of cases where anti-social conduct has been precipitated by an unfavourable environment or is the cumulative effect of such an environment. In these cases the part played by heredity is that of a minor or predisposing cause. Delinquency in general cannot be attributed either to a predominantly hereditary or a predominantly environmental origin. Its causation is far too complex for that. "Heredity appears to operate, not directly through the

transmission of a criminal disposition as such, but rather indirectly, through such constitutional conditions as a dull or defective intelligence, an excitable and unbalanced temperament, or an over development of some single primitive instinct. Of environmental conditions those obtaining outside the home are far less important than those obtaining within it, and within it, material conditions, such as poverty, are far less important than moral conditions, such as ill discipline, vice, and most of all, the child's relation with his parents." We consequently realise that for the moral welfare of the nation, the problem of nature and nurture is not mainly a biological one, but rather a matter for the home and the school, where sound discipline is the breeding ground of the social virtues.

WHAT IS INHERITED

There remains one very interesting problem which has been deliberately avoided up to this point. What exactly is inherited? Some scientific men and most popular writers seem to think that the mental tissue which is handed on from generation to generation has well-marked patterns woven into it, such as the instincts, or specific talents, etc. But since neither intelligence in general, nor any more limited capacity such as mathematical ability, can work *in vacuo* we can only separate nature from nurture by an act of logical abstraction. All that the study of mental inheritance can attempt, is to assign the relative functions of each in the acquirement of morality or knowledge. When we say that ability is inherited we do not mean literally what we say. All that ought to be meant by such an assertion is that, given the appropriate training, the individuals in question take to the training more readily and find satisfaction in exercising the ability when they have acquired it. An ability is a pro-

pensity, an appetite or 'drive' combined with a capacity to act on it. Now there is no pre-existing inherited capacity, but simply a propensity which will be satisfied when the capacity is acquired. Inborn drives are of the vaguest possible kind; mere restless strivings without defined objectives.

This is true even of those fundamental drives which are necessary to preserve life. It is often assumed that animals, in a state of nature, are able to select food according to their nutritional needs by instinct But in some recent experimental work on this point the investigators [21] say, "We have obtained good evidence that the behaviour of the animal is due not so much to instinct as to *experience*, i.e. of the beneficial effect produced by a particular food stuff" The evidence was obtained by feeding rats for three weeks on a diet devoid of the essential vitamin B Their appetites dropped, their hearts beat at a much lower rate, and they lost weight. At this stage they were offered a choice of differently flavoured vitamin-free foods together with one containing the necessary vitamin. But they had no inclination or ability to choose aright, and continued to starve on the wrong diet in the presence of good food, owing to their previous experience. At this point they were offered only a diet containing the essential vitamin for two or three days. They recovered rapidly in weight and general physique by this 'education,' and when offered a choice of different diets, exactly as before, they chose aright; so potent is the effect of experience where vital needs are in question. It was even shewn that depleted rats prefer to restrict themselves to a monotonous diet to which they have been 'educated' and on which they are thriving, though they have alternative diets offered to them which would be readily accepted by non-depleted animals. These observations shew that it is the experience of the immediate beneficial action of the vitamin-containing diet which makes the depleted rat choose it. The pleasant

sensations incident to his recovery are associated with some characteristic smell or taste of the food which makes him prefer a diet which would otherwise not attract him It is clear that the right choice of diet cannot be left to instinct, but is an art that has to be acquired even by the lower animals. As a result of their experimental work the investigators say, "It seems reasonable, indeed, to suggest that the very desire for food itself (as apart from the choice between different articles of diet) has an experiential no less than an instinctive side "

If it is true of even the most primitive and essential drives, such as that for food, that they have no definiteness apart from experience, it is not to be expected that other propensities should have any definite objective I have shewn in detail in the *Mind and its Body* that human propensities, such as the so-called instincts, acquire such precision as they have entirely from experience. So that, however paradoxical it may seem, an inborn capacity has to be acquired. Accordingly, though Galton found that talent runs in families, he also discovered that the relatives of talented men might have talent of very different sorts Where the ability is of the same sort, the influence of the environment is adequate to account for the similarity.

The upshot of the whole matter is that it is misleading to view mental inheritance after the analogy of material inheritance. Just as we may inherit the family jewels so, it is supposed, that we inherit the family intelligence and the specific family talent. But the evidence we have considered does not bear this out. All that our ancestors have left us is a clue to the mines from which the ore was extracted to fashion the family jewels. We start life with vague impulses to decipher these clues. Those in whom the impulses are not strong enough never make out the clues ; others decipher the clues but lack the necessary industry and these, too, fail to acquire their inheritance.

CHAPTER III

SENSORY DATA—VISION AND HEARING

Sense Training—Visual Acuity—What the Eyes See—Auditory Acuity—Legibility of Printing Type—Illumination—Psychology of Reading

SENSE TRAINING

MORE than any other single factor, the influence of Locke's sensationalistic psychology directed general attention to the importance of sense training in the education of children. Various educational reformers since the time of the Renaissance had pointed to the aid of the senses in acquiring knowledge; thus, Mulcaster in his *Elementarie* stated: "The hand, the ear, the eye be the greatest instruments whereby the receiving and delivery of our learning is chiefly executed." But, as this quotation shews, they failed completely to grasp the fundamental idea that education of the senses is more than the means of acquiring knowledge; that it is in itself the earliest form of mental development. It remained for Rousseau, basing himself upon Locke's ideas, to stress the fundamental fact, never thenceforward to be forgotten that education must begin with sense training. Pestalozzi and Froebel contributed to the development of the idea and owed a debt in this respect to Rousseau. Nevertheless our exact knowledge concerning the part played by the senses in intellectual and moral development derives from a totally different source.[1]

The experimental investigation and practice of sense

training began with J. R. Pereira (1715–80) who undertook the teaching of deaf-mutes, after having made a thorough study of anatomy and physiology. He was the first to demonstrate the fundamental nature of the sense of touch and the possibility, as we may call it, of the substitution of one sense for another. Deaf-mutes by practice improve their tactile sense, and by systematic graduated exercises based on the analysis of sounds Pereira was able to train his pupils to differentiate clearly the minute vibrations of the vocal cords The pupils grasped the throat and mouth of their teacher, acquiring skill in the discrimination of the different vibrations He also taught them carefully to observe by the sense of sight the position and movements of the throat, jaws, tongue, teeth and lips during sound production. So delicate did their sense perception become that when, under the influence of this training, they began to talk themselves they reproduced their master's Gascon accent! Not only did this education improve their senses but better social and moral development ensued More than a century later the blind deaf-mute Helen Keller, taught in a similar way, stated: "By placing my hand on another's throat and cheek I enjoy the changes of the voice I know when it is high or low, clear or muffled, sad or cheery The thin, quavering sensation of an old voice differs in my touch from the sensation of a young voice. . . . Sometimes the flow and ebb of a voice is so enchanting that my fingers quiver with exquisite pleasure." Rousseau lived near Pereira, visited him, and saw his work, and probably the sections in *Émile* on sense training owe much to this source

In order to appreciate the significance of sense training for moral and intellectual development it is necessary to turn to the observation of idiots. For normal children in their play and general activities, even without formal education, acquire control over their motility and sensibility. Not so idiots, who exhibit inertia or merely spasmodic uncontrolled

movements. Philosophers of the 18th century had a great predilection for the natural man unspoilt by the touch of civilisation. An opportunity of studying such a case occurred when a wild naked boy who had lived for seven years out of eleven or twelve in the woods in Aveyron was brought to Paris. Luckily he was not left to the philosophers, but entrusted to the care of Dr Itard (1775–1838). He turned out to be an idiot and the state of his sensibility may be judged from the fact that snuff did not make him sneeze or produce tears, loud shouts failed to attract his attention; he would seize hot coals or place his hands in boiling water Pistol shots fired close to his head produced no effect, yet the cracking of a walnut of which he was very fond, immediately attracted his attention Dr Itard succeeded after several years of patient effort, by graded sense exercises, in restoring some of his sensibility, and though he failed to moralise him completely he did ultimately shew signs of moral qualities.

Dr Séguin (1812–80) carried on and improved the work of Pereira and Itard. With infinite patience and scientific insight he developed a complete system for training the motility and sensibility of mental defectives. He worked on the idea of the organic unity of body and mind in the educative process. By preparing a suitably simple environment, with specially devised apparatus and carefully graduated exercises, he enabled the defectives to cope effectively with the simplest situations of social life. He demonstrated conclusively that by cultivating sensibility we achieve intellectual and moral progress. He also shewed that with these children the essential thing was to awaken wants, since it is only by spontaneous functioning that the senses are developed. Dr Montessori copied Séguin's methods, and successfully applied the idea of a prepared environment and didactic sense apparatus to normal children. By her wonderful sympathy and affection for children she was able to inspire others

with the ideas of her predecessors and make them widely accepted.

It is unnecessary to enter into details of the special methods employed in training the senses, since there is a large literature devoted to practical kindergarten work. However, it is desirable to call attention to an epistemological consideration the neglect of which may lead to educational mispractice. In the early stages of education a good deal of what the mind deals with is locked up in sense material or, at all events, needs the stimulus of sense-impression. The kindergarten teaches the discrimination of the various colours and shapes by practice with graded sense material, and rightly teaches number in the same way by handling beads, sticks, etc Hence it is easy to be misled into supposing that the knowledge of arithmetic, like that of colour, rests wholly on sense data But the similarity of the cases is only specious, and the distinction has been most aptly pointed out by Mr Bertrand Russell who says, "A certain number of instances are needed to make us think of two abstractly, rather than of two coins or two books or two people or two of any other specified kind But as soon as we are able to divest our thoughts of irrelevant particularity, we become able to *see* the general principle that two and two are four ; any one instance is seen to be *typical*, and the examination of other instances becomes unnecessary " [2]

It is a matter of insight for the teacher of the young to discern when the sense-training stage of the process is sufficiently complete, so as to relieve the mind from irrelevant particularity in order that the abstract may be freed from the mass of concretes. So, in teaching geometry, a practical course of measurements is highly desirable in the early stages, in order to exemplify and suggest the general propositions underlying the science and to help the memory, but there is no other method than that of close reasoning by which the theorems can be really acquired. Yet, when all is said, without

the sensory basis the principles would not emerge, and general ideas are picked up largely by reading and the like sensory aids. Conformably to this there is some evidence in support of the view that lack of sensory acuity is responsible for reputed dullness and apparent stupidity in children. Hence we turn to the consideration of the sensory and environmental conditions without which education is likely to be ineffective.

VISUAL ACUITY

Measurements of visual acuity are rough and ready, and yield figures which are comparative only for the readings taken by the same observer at one time The standard acuteness of vision is taken as the power of the single eye to distinguish letters and characters which subtend an angle of five minutes on the retina, all the vertical and horizontal strokes which compose the letters and all the spaces between the strokes producing a retinal image of one minute. As the tangent of five minutes is ·00145 the size of the standard or test-type letters which are to be read by the "normal" or emmetropic eye at a distance of one metre is 1·45 mm. vertically and horizontally, and proportionately greater, in a direct ratio, for longer distances. There are several factors which influence the measurements, such as variations in illumination, in blackness of the type, in the colour of the background, etc., so that it is difficult to compare the results of different observers. The fraction obtained, by dividing the distance at which the letters of standard size can be read by the individual by the distance at which the 'normal' eye can read them, is taken as the measure of his acuity of vision.[3] The method is, at best, only approximate, as much use is made of conscious and unconscious inference in reading the letters, and as we shall see later the legibility of type is

dependent to a considerable extent on the forms of the letters By a strange freak of typographical perversity the letters most frequently used, especially the vowels, are amongst the least legible of the letters. Some of these difficulties are countered by the use of single letters of the standard sizes such as a series composed of lines of E's, or for young children a series of squares with one side missing is employed and they are required to indicate, by pointing, which is the open side; or sometimes a series of small pictures of the standard sizes is used. For more exact measures an international test is now used, consisting of a broken circle mounted on a rotating graduated dial. The observer indicates the direction in which the opening lies. The opening is turned in eight different directions and the observer must indicate five correctly. The size of the opening can be varied at will Nevertheless, even with these refinements the task of measuring visual acuity is complicated by the factor of human variability A recent scientific investigation [4] led the experimenter to the conclusion that, "It is far from easy to arrive at a figure which we can say represents the visual acuity, or the fineness of colour discrimination, because the subject is continually varying. We cannot say why these internal variations in the human subject occur in the absence of any known external stimulus. . . . There is probably no such thing as 'the visual acuity' of a subject except for a fraction of a second. It is constantly changing."

Sometimes visual acuity is measured by the greatest distance at which a particular kind and size of type can be read by the persons examined. In the anthropometrical survey of Cambridge students [5] in 1887, in which over two thousand men were examined, acuity was measured by the extreme distance at which 'diamond' type could be read by each eye separately, the mean of both eyes being used as the index. The mean distance for all the students was 24·1 inches. They were next

divided on the basis of general ability into three groups, A, B and C, comprising first class honours men, other honours men, and those who read for an ordinary degree or who failed in honours. The mean index for each of the classes was A, 23·4, B, 24·1 and C, 24·4. There is thus a slight inferiority in respect of acuteness of vision amongst the most studious men; and this defect was found to be largely due to the greater proportion of students in this group who could not read the type at any distance without glasses. In other physical traits, such as height, weight, muscular strength, breathing capacity, etc., there was no difference between the groups, from which it was inferred that much reading tends to produce myopia.

It must be remembered that the eyes of children are in a dynamic state. At birth practically all eyes are long-sighted or hypermetropic But this condition steadily decreases until about the age of fifteen or sixteen years, when 'normal' or emmetropic vision gradually supersedes it.[6] Emmetropia below the age of twelve years must be looked on with suspicion, as such rapid development may be the incipient stage of early myopia Close eye work or overstrain in childhood and early adolescence is the most prolific cause of myopia. This is well brought out in the following table which shews the percentage incidence of defective vision in about six thousand secondary school pupils in different parts of the country[7]

	Boys.		*Girls.*	
Ages	Defect of $\frac{6}{12}$ or less.	Worse than $\frac{6}{12}$.	Defect of $\frac{6}{12}$ or less.	Worse than $\frac{6}{12}$.
12	12·1	11·7	15·8	13·3
13	9·7	12·1	14·7	18·6
14	11·8	13·4	12 7	19·4
15	10·5	17·3	14·2	20 4
16	11·8	20 2	10 1	21·5

The table clearly indicates that defective eyesight is more frequent in girls than boys, which is associated with the fact that they do needlework and other fine work and are more

conscientious in doing homework. But another reason is their greater proneness to anæmia, which by affecting the nutrition of all parts makes the eyes less able to endure strain. The figures also indicate that, whilst the total amount of defective vision increases in both sexes, this is due to the increase of the major degrees of defect with increasing age, for the minor degrees shew no appreciable change. Although heredity cannot be excluded, environmental conditions are in the main responsible for ocular defects during school life. Bending over work, which produces congestion in the eyeballs, and the muscular strain of prolonged accommodation for near objects bring on progressive myopia; whilst good lighting, correct posture and other hygienic conditions may prevent its onset

Not only does school work, by producing strain, affect visual acuity, but the conditions of town life are likewise inimical to good vision. This has been shewn by the increasing percentage of defective vision and squint found in children the farther they are removed from the country. The following figures shew the percentages of defective vision and squint obtained by examining over a million primary and secondary school pupils: Counties 9·2, Boroughs 9·5, Urban districts 10·6, County Boroughs 11·2, London 12·9 Nevertheless, owing to the improvement in hygienic conditions in schools as the result of medical inspection, visual acuity in all areas has steadily improved since inspection began in 1908. And, for the same reason, the disparity between boys and girls is diminishing, especially at the age of twelve years.[8]

WHAT THE EYES SEE

One of the Binet tests of intelligence consists in shewing the child some pictures which he has to describe. It is found

that, for normal children, it is not till the age of six that they are able to describe the purport of the picture or the actions displayed in it, and by the age of twelve they go beyond what is actually visible in the picture in order to interpret it. At the age of three all that the ordinary child can do is to enumerate items in the picture. If a child of this age is observed closely whilst he examines pictures in a book it will be seen that he simply enumerates details. He apparently gets no general impression, but selects details haphazard. When, however, the picture is limited to a single object some attempt is made to interpret it. It apparently makes no difference to the child whether the thing is known or not, for he immediately assimilates it to what he does know, e g. a peacock is called a pigeon ; a swan, a pheasant or even a giraffe or camel is a cock, and so forth. The most characteristic procedure adopted by children is to interpret by similarity, however remote it may be ; and to fasten on to some dominant characteristic to the exclusion of all else. Anybody who looks carefully at the profile of the head of a cock with its characteristic line and curve can, if he fixes his attention solely on these, see the similarity between it and a giraffe. The caricaturist, in taking advantage of such naive similarities to produce startling effects, is appealing to the child in us ; and that is no doubt why he is such a powerful influence in politics.

In matters connected with vision and, in fact, with all other sensory data the neglect of psychological considerations is apt to lead to gross error, as we shall see when we come to deal with the legibility of print. For the physical stimulus, measured objectively, is not the same as the psychological stimulus. The study of geometrical optics is most misleading in this connection, for in books on this subject dealing with vision it is taken for granted that the image on the retina is simply a reproduction of the actual object in miniature.

Apart from the fact that the inner surface of the eye is curved, which renders the assumption invalid, it is overlooked that the dimensions of the cones of the retina, which are the organs of vision, are comparable in size to the wave-lengths of light. The images in the retina are, therefore, certainly different from what would be expected geometrically, owing to the interference with the waves of light which such minute objects must entail.

Moreover, an interesting and valuable investigation by Professor R H. Thouless [9] shews that the stimulation of the retina by rays of light does not account for what we see What we see is a compromise between what the stimulus suggests and what we know to be there. This phenomenon is known as the phenomenal regression to the real object. Despite its somewhat forbidding name everybody is familiar with the experience it suggests every moment of his waking life. If we look along a street and see two men of the same height at different distances from us they *look* to be of the same height, and yet the size of their images on our retina is certainly different. A child near us looks smaller than a man some way off, though the retinal images may be of the same size or larger for the child

Mr Thouless made a careful experimental study of this phenomenon. If a person looks at an inclined circle and is asked to select from a number of ellipses the one which most closely resembles the shape he sees, he invariably chooses an ellipse which is widely different from that which represents the true perspective shape; being much nearer the circular form. The person sees neither the 'real' shape nor the perspective projection on his retina, but a compromise between them. The shape of the inclined circle, which is projected on the retina, may be called the perspective or stimulus shape, as it is this shape which is setting up physiological processes in the optic nerve. The shape which the person reports that

he sees is the apparent or phenomenal shape, and in all cases this is nearer the circle than the stimulus shape Similarly, if two circular disks, one larger than the other, are set up in vertical planes and moved relatively until they seem to be of the same size, the larger disk must be placed at such a distance that its perspective or stimulus shape is considerably smaller than the other disk. Or if a square, inclined from the vertical, is placed with one diagonal pointing to the person he sees the semi-axes of that diagonal as equal; though, of course, the part farther away must be shorter. "It is as if the known physical shape of the object distorted towards itself the seen shape from that which we should expect to result from the sensory cue of the image on the retina."

The phenomenon has also been observed with regard to receding parallel lines, which likewise appear to regress from the convergence of their perspective character to the parallelism of the real object. In some peculiar cases such lines may even appear to diverge.

Nor is the phenomenon of regression to the real object confined to shapes and sizes. It holds also with regard to apparent brightness and colour. If a piece of grey paper is placed near a window and a piece of white paper farther in the room so that its luminosity is actually less than the grey, it nevertheless appears brighter. And the same thing happens with colours, for the hue of coloured objects seems to remain fairly constant in spite of the changes in the intensity of illumination or even in the colour of the illuminating light. As, for instance, a newspaper appears white though we read it by the aid of a yellowish electric bulb. In all these cases we see what we know to be there and expect. Some modern artists, however, persist in trying to see things as they really appear both in shape and colour. The importance of this in teaching art needs to be emphasized and will be dealt with in a later chapter on æsthetic appreciation. When the dis-

appointed man came away from an exhibition of modern painting exclaiming, "Thank Heaven things are not as bad as they are painted!" he overlooked the fact that the artists were trying to paint objects as they really appeared to them, instead of how they ought to appear by scientific rules of colour and perspective.

AUDITORY ACUITY

Until quite recently the methods employed to measure auditory acuity were of the most primitive. The maximum distance at which the ticking of a watch could be heard, when moved from or towards a person, was a rough-and-ready method. Another measure was obtained by the distance at which words said in a 'forced whisper' could be heard. The latter method gives much better results than the former, and was widely used by school medical officers. The whisper test approximates more closely to the kind of hearing required in schools; but, by its use alone, cases of partial deafness requiring early treatment cannot be detected.

An audiometer [10] is now used by some educational authorities, and is a very accurate instrument. It consists of a gramophone which speaks a series of three-figure numbers, through headphones, in measured gradations of loudness. Units of loudness are called decibels and have been graduated for telephone engineering and broadcasting; the energy corresponding to a decibel being accurately measured. The instrument is graduated in decibels below and above a zero which has been determined by testing thousands of normal people. 'Normal' ears require a degree of loudness between -3 and 6 units. A person who can hear a word at a degree of loudness represented by -3 decibels has abnormally acute hearing. Whilst a loss represented by 9 units or more is

the beginning of deafness and requires treatment. Each ear is tested separately and by a series of headphones in relays, a number of pupils can be tested at the same time. The pupils write the numbers they hear, at each degree of intensity, on a record card. The degree of loudness is stepped down, three decibels at a time, until a threshold is reached at which mistakes begin to be made.

Of 4,667 children tested in a London borough, between the ages of seven to fifteen years, 91·5 per cent were 'normal,' and 398 or 8·5 per cent had some defect in one or both ears. The number of defective ears was 525, with the following distribution. The top line shews the loss in hearing units and the bottom the number of ears affected.

9	12	15	18	21	24	27	30
202	133	76	47	25	17	9	16

It is only in rare cases that deafness is due to defects in the auditory nerve apparatus. The loss of hearing power in children is due to one of three conditions: inflammation in the nose, Eustachian tube or middle ear; suppuration in the ear; or wax in the external ear. All these conditions can be treated, and it has been shewn that if attended to early, deafness can be cured and the child becomes normal. A child with a loss of 30 units requires some special education in a separate class, and all with a loss of over 40 need to be in a special school for the deaf. If the hearing loss in the better ear is 18 units the pupil should be placed near the teacher, and it is advisable to teach him lip reading to help him out.[11]

LEGIBILITY OF PRINTING TYPE

Visual acuity should be distinguished from visual sensitiveness. Every impression made on the retina must persist

for a certain time in order to excite a sensation, and degrees of sensitiveness have been measured by variations in the time required to recognise the impression. In order that a letter of the alphabet may be read, the impression must persist for more than a thousandth of a second [12] The shortest exposures which suffice for the recognition of letters also admit of the reading of short words, in fact the time necessary for reading words may be shorter than that required for reading letters owing to the greater facility in the recognition of a more extended form. Some letters as s, g, c, x are hard to see owing to their form and others because they are apt to be confused with each other, e.g. i, j, l, f, t Three times as many letters can be grasped in one exposure when they make words, and twice as many words can be read in the same time when they make sentences. It is clear, then, that sensitiveness depends not only on overcoming the inertia of the nervous system but also on the facility of mental assimilation We respond, that is, not to the bare impression received on the retina but to the acquired meaning conveyed by it

The problem of the legibility of different 'faces' of printing type has been investigated and discussed for over a century; and in the last few years important changes in type faces have been made in order to secure greater legibility. The chief difficulty in the investigations has been to define what is meant by legibility, since no less than fifteen different criteria of legibility have been made use of at one time or another. Some experimenters have tried to determine legibility by the speed at which letters can be read, others by the distance threshold for reading, others by the intensity of illumination which will just make type readable, some by the number of errors made in reading under standard conditions, and so on. The more closely the problem is studied the more complex it becomes. Most experimenters have sought for some features in the type, such as the width of

the letters, or the spacing, or the thickness of the strokes, or the æsthetic quality of the print, which would give an objective standard of legibility.

Such investigations, however, have not been very fruitful owing to the neglect of the psychological aspect of the matter. Reading is essentially a psychological act performed by a person in an ordinary sitting position, in a full light, with the print at distances from six to sixteen inches from the eye. The most recent and thorough investigator, Mr R. L. Pyke,[13] says that legibility refers to matter which can be easily read *under these conditions*. And he pertinently adds, "To read means to obtain meaning from written or printed symbols. But does 'easily' mean accurately, or rapidly, or both? Or does it mean with little effort, and if so, does that mean without eyestrain or without fatigue (both the latter involve some reference to an extended duration in time; accuracy and speed do not)? It does not follow because you read accurately, or rapidly, that you do so without effort (it may be only by an effort that you do either); nor that you read accurately or fast because over a long period you read without eyestrain or fatigue."

The most suitable criteria to adopt are speed, and accuracy as judged by the number of errors made in reading. Yet, even if we limit ourselves to these, the problem is by no means simple, since speed of reading depends not only on typographical qualities but on a large number of subjective factors. Amongst these are included visual acuity, alertness, comprehension, early formed habits, whether we read for amusement or instruction, and so forth. According to Mr Pyke the essential and sufficient conditions for legibility are "that it should be possible (1) with letters for the eye to define clearly the shape (2) with words the collective shape (3) with continous texts, to read a type both accurately and rapidly."

Experiments were carried out by Mr Pyke both with nonsense material and sense material; the subjects being required to read aloud as fast as possible under conditions as close as possible to normal reading, with controlled artificial illumination. The number of errors made in reading the nonsense material was taken as a criterion; whereas for the sense material the total number of letters read in a given time was used. If legibility were a quality of type 'face,' the type with the largest number of errors should have the smallest number of letters read But no such correspondence could be discovered with the various faces of type that were used The conclusion reached was that the measurement of objective legibility is so hopelessly complicated by ingrained reading habits and other psychological factors that the task is well-nigh impossible. Persons become so adapted to particular kinds of type that very large changes must be made before any difference of reaction can be detected. Old English or Gothic type may be more legible to one who is brought up on it than Roman characters. There is, in short, no objective optimum legibility; and the attempt made by early investigators to impose uniform experimental conditions, so as to secure scientifically objective results, sacrifices the psychological conditions which ultimately determine legibility.

From what has been said it will be realised that we ought to draw a distinction between what is easily perceptible and what is legible. Words have a configuration of their own distinct from the forms of the letters composing them. The isolated letters constitute, as it were, a background from which the figure of the word stands out. Legibility appears to be some quality of the configuration of the word that 'looks right.' This implies a correctness of the space-distribution between the letters, and a type that is simple, fairly broad, with strokes fairly thick, but not too much contrast between the thick and the thin. The legibility of type provides an

instructive example of our statement in the first chapter that a psychological whole cannot be regarded as a sum of its parts, since there is a quality which is distinctive of the configuration as a whole. The separate letters of a fount of type may be easily perceptible when looked at in isolation and yet the print may be lacking in the quality of legibility.

There is another criterion which should be applied to a fount of type intended for general use in addition to legibility, namely readability. This is a matter entirely of individual experience, and illustrates in an interesting way an important aspect of mental development. In a later chapter the topic of mental imagery will be discussed, but the images there considered are mainly particular. Here we are concerned with what are known as generic images. As a child develops and meets the same kind of objects, time after time, in very different settings he gradually acquires generic images of these objects. Thus he gets generic images of men, women, trees, birds, and so forth; images which are general or 'universal,' and so applicable to any particular specimen of these various things. He may be able to recognise a bird without knowing what kind of bird it is. The generic image is like the equation to a parabola, which represents every parabola without recalling any particular one. Such generality is the distinguishing mark of generic images. Images of our familiar friends are apt to be less concrete than those of persons seen only rarely, for the former are met with in a diversity of settings. An actor seen but once in a part would leave a more concrete image of himself. As a person receives impressions of fount after fount of type from books and papers there grows up in his mind a generic image of 'type.' A fount of type which chimes in with this image in the mind of the reader will be regarded by him as eminently readable, since it is so easily assimilable, and he will prefer it to any other type which may be constructed as the result

of scientific inquiry into legibility. Just as a lover regards the face of his beloved as the ideal type of face. It is of great importance therefore that the type used in school books should combine æsthetic qualities with legibility, for that will determine that the next generation will only be satisfied with print that is æsthetically satisfying.

Of the eight 'faces' used in his experiments Mr Pyke believes that, under laboratory conditions type (i) shewn below is the most legible, and type (ii) the least legible. This might not be the case under other conditions. For comparative purposes I have appended type (iii) the new Roman fount recently introduced by *The Times*, as this seems to me to combine the qualities of legibility and readability. It is most suitable for the short lines of the columns of a newspaper, but would have to be modified for printing books, so subtle are the qualities which influence readability.

(i) ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

(ii) ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

R+L

(iii) ABCDEFGHIJKLMNOPQRSTUVWXYZÆŒ
abcdefghijklmnopqrstuvwxyzæœ

ILLUMINATION

The effect on the eye of different conditions of lighting has been carefully examined under the auspices of the Ameri-

can Medical Association.[14] By means of visual acuity tests, records were made of the time that the eye could maintain a certain standard of acuity, and the time it fell below it, during a three-minute test. The ratio of these times is regarded as the measure of the ability of the eye to maintain its power of clear seeing, and this ratio was calculated before and after reading under different conditions of illumination. The effects of evenness of illumination, diffuseness of light, the angle at which the light falls on the object viewed, the evenness of surface brightness were all shewn to be important in maintaining visual efficiency. A field uniformly illuminated with light well diffused, and no extremes of surface brightness, such as is given by daylight, is the ideal condition for accurate and comfortable fixation and accommodation of the eyes. Systems of artificial lighting are classified as direct when the light is sent directly by a reflector to the plane of work, and indirect when the source is concealed from the eye and the light is thrown against the ceiling which reflects it diffusely In semi-direct systems a part of the light is transmitted through a translucent reflector placed beneath the source and a part is reflected from the ceiling. The indirect systems and the semi-direct, in which but a small portion of the light is directly transmitted, were found to give the best results. In the indirect system the highest intensity of light may be used without discomfort to the eye. Unevenness of surface brightness in the field of vision brought about by direct illumination proved to be the most important cause of the eye's loss of efficiency, discomfort and fatigue. A recent investigation has shewn the importance of a minimum standard of intensity of light to secure favourable conditions of work. Two rooms of identical size and window area, both facing the same way were selected in a modern school building. One of them was equipped with two 150 watt direct-lighting lamps which were switched on when it was thought necessary. The other had

indirect lighting with four 300 watt lamps controlled automatically by a photo-electric relay or 'electric eye,' so arranged as to function when the natural light in the darkest part of the room fell below an intensity of 12-foot candles. There were between thirty and forty pupils in each room graded so as to be equivalent groups in intelligence and school attainments. At the end of a year it was found that 94 per cent of the pupils in the room with controlled lighting were eligible for promotion whereas in the other room there were only 68 per cent.

Books used in schools should have paper without or with only a little gloss so as to avoid specular reflection producing differences of brightness which interferes with binocular vision. In order to secure greater legibility and less glare Babbage had tables of logarithms printed on paper of a primrose yellow tinge. Such a tint is very useful for all sorts of tabular work, especially in artificial light Babbage selected this colour after tests of printing in various tints, and finding out which his friends preferred; and he was of the opinion that different people might find different colours less fatiguing to the eye.[15] The French Government has adopted the plan in printing the official logarithm tables of the geographical survey for the army, and experience has shewn that this device does diminish the strain on the eye brought about by the intense contrast between white and black, and irradiation effects in close work; so that those who are introduced to them prefer to use these tables to others. The colour is not meant for the ordinary reader, for whom quality and texture of paper is much less significant for legibility than is usually supposed.

The loss of visual efficiency in an unfavourable illumination has been shewn to be muscular and not retinal. For the retinal loss in capacity (as tested by the power to discriminate colour and brightness, rate of exhaustion and recovery) was not greater in the above-named investigation under one than

another of the lighting systems employed, even after ten hours work.

Some of the muscular strain is the result of the effort of fixation and accommodation, but part of it is due to a cause first pointed out by Dr Javal in 1879. In reading, the eye proceeds by a succession of quick, short movements and pauses, from left to right, and then sweeps in one quick unbroken movement to the next line The short jerks vary in extent and some of the pauses are longer than others. By photographic methods the extent and duration of the movements has been ascertained and it has been found that the movement spaces are irregular, a slight movement may be followed by one three to four times as great, the angular displacements being from 2° to 7° The number of pauses for any person is, on the average, fairly constant for lines of the same length. With familiar matter there are fewer pauses, but the number is increased for foreign languages, detached words, lists, etc Smaller type somewhat increases the number of pauses and movements. For fast readers the pauses are rather less than ·2 sec., but the variations are very great. Fast reading decreases the number of pauses and their duration but not the speed of the movements, which is outside the person's control, so that fast readers perform less eye work. Children are found to make more frequent and longer pauses than adults, for it is the attention which is ahead, as it were, and pulls the eye along in reading.

Differences in the rate of reading depend largely, according to Professor Huey, on the ease with which a regular rhythmical movement of the eyes can be established and maintained. The swing from one end of the line backwards to the next has been happily compared with the motion of an oarsman's body between the strokes. The habit of swing is normally well established by the age of nine to eleven years, i.e. the necessary eye swing is then made without conscious effort

and with considerable regularity To accomplish this the length of the line in school books is important, and uniformity is desirable The small irregular movements are apt to be fatiguing to children, and irregularity in the swing works to the same end

THE PSYCHOLOGY OF READING

The actual reading range of the unmoved eye is restricted to a small area of a couple of centimetres radius round the fixation point [16] Hence we must distinguish between what is actually 'seen' by the eye and what is supplied mentally by suggestion or interpretation and unconscious inference The interpretation is made so readily and the suggestion is so subtle that ordinarily a person thinks that the whole page is visible to him at once. The span of prehension is about five letters, i e the number of letters which can be grasped in one act of attention, as for instance by a momentary exposure, is limited to this small number. Yet, by practice, words have become united in unitary complexes, and sentences into larger complexes, which function as wholes, so that by a single act of apprehension we can take in about thirty letters provided that they constitute a sentence Anybody who reads characters in a foreign alphabet such as Greek or Hebrew can easily distinguish what is 'seen' from what is supplied by the mind's store

So, too, we are able at once to recognise the most complicated figures, if they are presented in symmetrical form, as a whole, though the analysis into constituent lines may not be possible. A good deal of the æsthetic feeling accompanying symmetrical shapes is brought about by such facility in recognition. In a similar fashion, as has been often pointed out, we may find no difficulty in hearing the actors on an English

stage, yet if we go to a foreign theatre we are at once struck, not so much by the effort to follow the language as by the physical difficulty of "hearing" the speech. Such an experience makes us vividly realise how slight are the 'cues' which sensation supplies to our perceptions and how much interpretation is necessary in order to give them meaning. Words can be read at distances from the fixation point of the eye at which single letters are not recognisable. The length of the words and their characteristic general form as visual wholes are sufficient for recognition. For the same reason, it has been demonstrated that words are recognisable when formed of letters not separately identifiable, owing to their size or their distance from the eye. The whole word must consequently be taken in as a single unit, in which certain forms are determinable and the rest indifferent. Only when the sequence of letters is unfamiliar is it necessary to be able to see the individual letters, as we find in twilight, when the power to read our own language may be unimpaired, whilst a foreign language, in which we are not very competent, is only legible with increasing difficulty.

With greater familiarity the stimulus which determines the reading act becomes slighter and slighter. Fewer and more sketchy 'cues' are necessary in order to touch off the act of recognition of word or phrase. A few dominating letters or shapes are a sufficient stimulus to enable us to supply the rest of the word in visual form. There is much of what is known as preperception—the seeing in the light of what has been previously acquired, the completion of what is only partially given, and the reading of meaning into symbols. The dominating, or characteristic form is filled out by the mind's eye into the complete visual form of the word or phrase. The reader reacts not to the mere visual shape but to its acquired significance, for it is the total situation which is the 'object' on which the reaction of the subject is made.

When a child acquires the physical act of reading he has learnt to respond to acquired meanings. What he thenceforth mainly perceives is not a set of printed symbols but a series of meanings It is only in a set of characters totally unknown to us, as Chinese, that the attention can be arrested by the bare visual forms apart from the meanings they convey

The early reading of children is universally accompanied by lip movements, and even though no sound is made the movements are accompanied by inner speech Now this inner speech without noticeable movements of the organs of articulation is also common amongst adults It must not be confused with actual lip and tongue movements which children and illiterate adults make when reading. Its elements are both auditory and motor, but it would be a mistake to suppose that it consists of the same elements as words when written or printed For it must be remembered that there is no phonetic basis for the division of a sentence into words, still less of words into syllables or letters In natural speech the sentence or phrase is an unbroken continuum which grammatical analysis has divided into words, which are later separated artificially into letters, in much the same way as the separate pictures of a cinematographic film break up the continuity of movement into a series of static views. The printed page gives an erroneous idea of the course of thought whilst reading, as it is not essential that the mind should grasp the details in order to understand the whole. For, as Professor Stout has pointed out, "it is certainly possible to think of a whole in its unity and distinctness without discerning all or even any of its component details," as when we think, e.g. of the meaning of such a term as ' wealth ' without having any picture of a bale of goods or a sack of gold Generally, written or spoken words, and the same applies to inner speech, suggest simply their *meaning* which is apprehended at once without recourse to mental imagery. If,

however, for any reason we are pulled up or stop to reflect or are baffled, then and then only does explicit inner speech or other imagery tend to arise. Accordingly, it has been found experimentally that a characteristic correlate of slow reading is inner speech. Such awareness of the whole without discernment of the parts has been called implicit apprehension, the details becoming explicit as occasion arises A few visual clues are adequate stimuli to arouse a whole wealth of meaning implicitly apprehended. In learning to interpret the symbols of speech by reading, the child daily reproduces for us, as in a microcosm, the characteristics of the mental evolution of the race in its efforts to grasp the meaning of the macrocosm So the best introduction to the study of educational psychology is to be found in an examination of the steps by which a child learns to read.

CHAPTER IV

THE STUDY OF OBSERVATION

Preperception — Plan of Investigation — Time Factor — Subjective Activity—Quantitative Results—Qualitative Conclusions

PREPERCEPTION

THE examination of specimens, the study of pictures, charts and diagrams, and so on, is an essential part of the technique of teaching in most subjects Apart from the appeal to the senses, these devices are rightly supposed, as we saw in the preceding chapter, to assist understanding Every practical teacher knows, however, that the mere looking at pictures or objects, or even the uncontrolled manipulation of them, no more assists comprehension than strolling round a picture gallery develops appreciation of art. No understanding without insight The educational value of sensory aids depends on a training in observation, and it might be supposed that experimental psychology would offer some aid in the study of the process. The present chapter is the first contribution to such a study, and experimental details are given to assist future investigation. There is an obstacle in the way of this inquiry which we shall frequently encounter when dealing with other matters. It is difficult to discover who placed the obstacle there, but possibly Herbart with his doctrine of apperception has the greatest responsibility.

According to his view, all conative activity was denied to

the subject and transferred to the presentations, for, said he, "in the soul there are only presentations, out of which all that is in consciousness must be constructed." He proceeded forthwith to elaborate a dynamics of the presentations, with the appropriate differential equations in the place of subjective forces. Such a parody of mental activity taken over into educational psychology led, as might have been anticipated, to a mechanical view of the educative process. But though the doctrine died in the educational world, frantic efforts are made by up-to-date psychologists to revivify it. There is supposed to be, as we saw in the first chapter, an obscure compartment, the unconscious one, in which ideas and images and affects crowd and jostle each other in their attempt to get into freer compartments. They do all this by themselves without any help from the conscious subject All that he has done is to shut them up, and woe betide the man who does so consciously or unwittingly, for they are so anxious to get out that they produce neurotic and other symptoms. The unfortunate subject can only look on and wonder what the pother is all about, for he never knows, and having no mental activity of his own he is powerless. This theatrical show is called dynamic or functional psychology, apparently because the subject has no function to perform.

If there were anything to be said for the theory it ought to be possible, by providing opportunities for the formation of a set of images, to exhibit their independent activity. Now the experiment described in this chapter offered ideal conditions for the establishment and arousal of visual images and their subsequent use in the process of observation. The detailed observations shew that there was no sign whatever of any activity by the images themselves apart from the conscious control of the subject. Previous activity exerted by the subject facilitated future activity, and made observation easier and more systematic. It is perhaps going too far to say that

images have no part to play in the process, but it is an incidental or subordinate one If it were desirable it would be quite possible to describe the whole of this process of observation by using the notion of mnemic causality without mentioning any images. Meanwhile, it is safe to affirm that all attempts to dispense with the notion of subjective activity on the basis of experimental work have so far completely failed We shall begin our study of observation with some account of the process of voluntary attention or subjective activity, since effective observation depends on this.

In summarising the results of previous experimental investigations on perception, in order to discover the nature of attention, William James came to the conclusion that three factors were involved, namely, the organic process of adjusting the sense organs, ideational preparation, and inhibition of irrelevant movements and ideas.[1] He considered that, in voluntary attention, the process of inhibition was merely an incidental feature and not an essential part of the process. It is evident also that conscious inhibition presupposes attention and, therefore, cannot, without circular reasoning, be used to account for it. The accommodation of the sense organs, although necessary for sensorial attention and probably always present in ideational activity, is a matter for physiology and need concern us no further. In any case, such adaptation is only a favourable condition of attention and not attention itself We are left, then, with ideational preparation or preperception as the distinguishing feature of the attentive process It is necessary, however, to avoid the doctrine of presentationism previously mentioned, according to which presentations are regarded as entities interacting amongst themselves; and to do so we must keep clearly before us the fact that the interaction of presentations is always dependent ultimately on attention.[2] The mistake here alluded to is especially prevalent amongst experimentalists

who are apt to confuse the conditions favourable to attention with the attentive process itself. Such process, as we have affirmed, involves the conception of mental activity, which is evident whenever a conscious state is the result of previous conscious process.

The term preperception was first used by G. H. Lewes. He pointed out that the effect of previous experience was to enlarge our present perceptions, making us more and more independent of the immediate stimulus, more and more masters of the external world The present is largely the resultant of the past revived as a present experience, "and this revival makes *pre*perception a factor in perception." In the same way a new idea "must be prepared for, *pre*-conceived by the exhibition of its points of similarity and attachment with familiar conceptions." Both a new object presented to sense and a new idea presented to thought must be "soluble in old experiences" before either can be perceived or comprehended. These phenomena have, of course been long recognised. Thus, in the "Midsummer Night's Dream" we read·

"Such tricks hath strong imagination,
That, if it would but apprehend some joy,
It comprehends some bringer of the joy,
Or in the night, imagining some fear,
How easy is a bush suppos'd a bear!"

And Wordsworth wrote.

"Of all the mighty world
Of eye, and ear—both what they half create
And what perceive."

Again in all ambiguous geometrical figures and patterns, a strongly imagined effort to see one form rather than another is usually successful in making us perceive the expected shape.

In his study of attention William James, following Lewes, states the theory of preperception as follows: "*The*

only things which we commonly see are those which we preperceive and the only things which we preperceive are those which have been labelled for us, and the labels stamped into our mind. If we lost our stock of labels we should be intellectually lost in the midst of the world." This doctrine, so vivaciously affirmed, consists of two distinct parts which, if true, are both of fundamental importance to educational theory. The first is that effective observation depends on preliminary knowledge of what we are about to observe, and in some sense this must be true, since the trained observer is more efficient in his own department than the untrained. The second implication is that language or an adequate terminology is essential to preperception. Both these positions are experimentally examined in this chapter so as to discover the precise difference made by previous knowledge and whether language is essential to the process of observation.

PLAN OF INVESTIGATION

Experiments with these aims in view were performed with over eighty university graduates, mostly honours men, taken in sets ranging from six to twelve in a group. The procedure employed with the last two groups is the most satisfactory and will be described in detail, but as the earlier experiments indicated by their results certain essential improvements in method they will be touched upon here. In general, the experiments were conducted on the following plan. Lantern slides were prepared, showing suits of armour, which were projected on to a screen in front of the subjects who were told to observe the picture as accurately as possible, as they would be asked to describe in writing all they had seen. After the first slide had been closely observed for

about one minute it was withdrawn, and the subjects were told to note down immediately every detail they remembered in as concise a form as possible and also to state any general observations they had made. No time limit was imposed and each signed a declaration, before giving up his record, that he had tried but could not recall anything else. The set of subjects was now divided into two groups, one of which had a lecture in which the structure of a suit of armour was explained, and illustrated by slides shewing drawings of each part, and the technical names of the parts were written up on the board. It was found that none of the subjects had any but the vaguest knowledge of armour, derived from hazy recollections of pictures or casual visits to museums, and the technical terms were almost absolutely unknown ; only three or four of the total number of students examined knew an odd term or two, but hardly knew exactly to which part it applied. When the lecture was over the two groups were again combined into one set, and were shewn another slide of armour for one minute , then they recorded their observations as before. Introspective records were also made. In this way it was possible to compare two groups , one with, and the other without, definite preperception. Marks were assigned on the following scale. Two were given for each part correctly noted (e g. neck guard, wings on knee) , one mark for each position correctly recorded (e.g. left foot advanced) ; and one mark for each correct description (e.g arm guard chased ; solerets pointed). The same numbers with a negative sign were assigned for incorrect observations under these heads, i.e. marks were subtracted.

The first set of subjects examined consisted of twenty-three graduates of average age twenty-six years. When the first slide had been shewn and records of observations had been made they were divided into groups L and N consisting of eleven and twelve respectively. The lecture was given to

group L and immediately afterwards both groups were combined and shewn the second slide, and then a third slide; records of observations and introspections being made after each.

For group N the average marks for the three slides were 29, 22 and 25 (the medians being 21, 24, 20), for group L the averages were 30, 38 and 38 (medians $30\frac{1}{2}$, $37\frac{1}{2}$ and $38\frac{1}{2}$). It will be seen that the groups were of unequal merit at the beginning, and that the group which had the lecture improved relatively only slightly more, if at all, than the other group. The outstanding feature of these marks is the surprisingly small difference made by the lecture in the power of observation. The introspective records make clear the reason for this; for, after the second slide, half the subjects in group L complained that the endeavour to remember the technical terms confused them and made observation more difficult. Some of the introspections may be quoted, as they illuminate different points Thus one subject said: "The technical terms were of use only in so far as they broke the suit into pieces thus indicating what parts to look for." Another said: "The knowledge of technical terms enabled me to work systematically," and this was confirmed by several. "The lecture aided the observation in that I used the sequence of the lecture and was able to *anticipate objects*, e.g. I looked at once for the lance rest." This may be compared with the following: "I would not have seen the lance rest if I had not expected it. I had to search for it. The lecture hindered observation because of the technical terms. If more time had been given after the lecture this might not have happened. The lecture, however, was of direct assistance in that after it much less attention was paid to such details as decoration, which was immediately dismissed as Milanaise, chasing, etc. In *this* way technical terms helped." The next two records indicate clearly why the lecture made so little difference. "The lecture aided me

because (*a*) it prepared me to deal with the suit part by part instead of wondering where to begin, (*b*) it was a guide to parts to look for. The terms helped observation when they were thoroughly known but hindered when I had a difficulty in remembering them." "The half-learnt terms obtruded when observation was going on, tending to a mixture of two endeavours—to observe, and to fix on the right terms; with the result that neither was properly accomplished In the few cases where the name was recalled without effort, the observation was helped."

It is evident that the chief effect of preperception is to introduce order into the observations and that technical terminology is only of assistance provided that it is thoroughly well known.

THE TIME FACTOR

With the next set of sixteen subjects special care was taken to see that the technical terms were well known, for which purpose the lecture was repeated twice and the terms emphasised Questions were also invited and answered. In order to secure a better comparison the subjects were divided into two groups of equal ability as measured by the marks obtained on the first slide. Two slides only were shewn this time. The results were puzzling since the group that had the lecture seemed to have profited by it astonishingly little compared with the other group, as the following figures indicate. The average marks of group N (the unlectured) for the first and second slide were 17½ and 31 (medians 15 and 29); for group L the averages were 17 and 34 (medians 19 and 33½). A further set of eighteen subjects gave the following averages for initially equivalent groups; group N, 19½ and 37 (medians 20 and 35); group L, 19½ and 51 (medians

21 and 53). This last result is much more what might have been expected *à priori*. There were still baffling results obtained with other subjects, owing to the eagerness of the groups who had the lecture to *concentrate on detail and to neglect general features*, which neglect caused a certain group of L subjects to score less than its equivalent N group in the second slide. Also several of the men required more practice to adjust themselves to the experimental conditions. The experiment was so interesting to nearly all the subjects that their eagerness militated against the calm which is essential to this kind of work, especially when they were shewn the first slide. It was evident, also, that merely being familiar with the structure of armour and the terminology was not sufficient to display the full effects of ideational preparation The subjects ought not only to learn their lesson but to have a sufficient period to digest it. Adequate time for mental assimilation of the knowledge given by the lecture turned out to be the kernel of the problem of observation. Attention is facilitated by preperception only when this condition is fulfilled. Time is of the very essence of the problem. During the interval there is an actual stamping in of the previous knowledge, a phenomenon to which Dr P. W. Ballard has given the name of Reminiscence. He says: "The belief that the change that takes place in the nervous system during conscious learning is to a certain extent continued when the learning has ceased is forced upon us when we consider those phenomena of reminiscence in which the physical basis is marked and manifest." He gives as instances the improvement of skill in swimming, skating, typewriting, etc. which occurs in the intervals when no practice is being taken; and concludes that "an actual modification of brain structure, of the same nature as that which is supposed to occur during learning, gradually goes on during the interval." [3] The only objection to this view is that the changes are sup-

posed to be purely nervous. There seems no sufficient reason to doubt that mental changes of a similar kind also take place during periods of inactivity. The results of the present series of experiments have convinced the author that mental changes, leading to better systematisation of facts and more adequate assimilation of terms, take place after the conscious learning has ceased. It is a blunder to suppose that remembering is a passive process in which the person reads off from a record what is written there. Rather the process is one in which continual changes are occurring.[4]

SUBJECTIVE ACTIVITY

The final method of experiment adopted, which proved satisfactory in bringing to light the effects of preperception, may now be described Sheets of paper were distributed to the subjects, divided into two columns with a subdivision for introspective remarks. The purpose of the experiment was announced as being the attempt to discover the difference made in observation by a preliminary knowledge of what one is about to observe; and the subjects were also told that they would be asked to describe on their sheets everything they could remember. They were likewise informed that suits of armour would be projected from the lantern on to the screen. Slide (1) was then shewn on a screen in a darkened room for 1½ minutes. This time was discovered by several preliminary trials to be the optimum. All agreed that the time was sufficient for a complete observation, but when they were asked at the end of the whole experiment for how long they thought the slides had been shewn their answers varied from 1 minute to 5 minutes. If a longer time is given several subjects begin to get restless and are apt to let their attention wander; with less time they feel hurried.

The slide was then withdrawn and immediately afterwards the subjects were asked to state in one column in brief catalogue form every detail they could recall, and subsequently in the other column any general observations which could not conveniently be considered as detail Any remarks they wished to make, not of an observational nature, were to be placed in the introspection column. As much time as was wanted was given to making these records, at the end of which the subjects wrote and signed the declaration " I have tried my best but cannot recall anything else " No sheet was accepted without this statement.

What the subjects were really trying to do was to read off from their memory image the details which they had noticed during their observation of the picture It may be objected that a good visualiser will be able to decipher details which he has not observed, but, as it were, photographed and subsequently developed. But this view has been shewn to be a mistake. The best visualisers, who claim to have perfect imagery, are not capable of reading off details which they have not *definitely* attended to. It has been demonstrated, for instance, that such a person claiming to retain a complete mental picture of the front of a building (say) is unable to read off the number of pillars unless he has definitely counted them Professor R. S. Woodworth, as the result of the study of his own imagery asserts that " it always consisted of facts previously noted." He goes on to say that " an actual situation presents an almost unlimited variety of facts or features, of which an observer notes a few, the rest remaining undiscriminated in the background. . . . Later he may ' remember ' the situation, but this is not to reinstate it in its original multiplicity or continuity. He recalls the features which he has observed, or some of them, but not the great mass of them which remained in the background. Lacking this setting or background, he is not in a position to make any fresh observa-

tion in recall." [5] In other words, the person only retains the configurations which he has previously discriminated from the background, and where the background is undifferentiated so that no pattern was discerned, no recollection is possible. Professor Woodworth's conclusions have been repeatedly confirmed in the course of the present investigation and also in some experiments undertaken by a totally different method by the present author. *In brief, we cannot study mental imagery without reference to mental activity and all that preperception can do is merely to facilitate such activity* [5]

The next step in the method was to interchange the records amongst the subjects The picture was again thrown on to the screen (this time in the lighted room) and they marked each other's papers in accordance with the scheme given above. Every doubtful point was referred to the author for his final decision and he subsequently examined the sheets. This method of marking has the great advantage that it forces the subjects to examine the picture in detail and stimulates interest and competition amongst the groups, which is necessary in this type of experiment. The method of evaluating the marks must take into account the fact that both groups have some practice in preperception; and this has been done in the calculations made below.

The whole process was repeated with a second slide (2) which was also shewn for 1½ minutes and marked in the same way. The marks for the two performances were added together and, on the basis of the totals, all the subjects were divided into two groups of equal ability. For the particular set of fourteen subjects whose results will be considered in detail the combined marks for the two slides were 354 for group L (the lectured group) and 343 for group N (the non-lectured group). It was not possible to get closer totals, as one subject proved so considerably superior to the others.

The advantage of combining two sets of readings lies in the fact previously noted that some habituation is required in order to allow several of the subjects to adjust themselves to the experimental conditions.

A lecture [6] on the structure of armour in which all the parts were named was now given to group L, the other group being dismissed. It was repeated twice and the various portions of a suit of armour were shewn on the screen, each technical term being written on the board At the end of the lecture, slide (1) was again projected on to the screen and the parts indicated by name. Finally, the terms were copied into note-books by the subjects who were told to go over them during the following week until they were perfectly familiar with them. Questions were freely asked and answered during the lecture In this manner the seven subjects of group L were enabled completely to assimilate all the terms and the details of the structure of armour, thus being placed in a most favourable attitude for preperception. All the subjects successfully learnt and could use all the terms freely. Exactly one week later both groups were recombined and two further slides (3 and 4) were exhibited, as before, the details of procedure being the same.

At the conclusion of the whole experiment, when the records had been marked and given up, the following questions were answered. Those who had the instruction stated whether and how their observation had been aided or hindered by the lecture and the technical terms ; those who did not have the lecture stated whether the absence of a terminology hindered observation and in what manner. They were expressly enjoined to give no theory but simply to describe their experience

THE QUANTITATIVE RESULTS

The combined marks for each subject for slides (1) and (2) at the first sitting, and for slides (3) and (4) at the second sitting are given below:

Without preliminary knowledge (*Slides* 1 *and* 2)

Group L		Group N	
Subject	Marks	Subject	Marks
A	94	*P*	61
B	54	*Q*	60
C	53	*R*	53
D	51	*S*	57
E	42	*T*	42
F	39	*U*	41
G	21	*V*	29
Mean	50 6	Mean	49
m d.	14 2	m d.	10

Coefficient of variation,* 28   Coefficient of variation, 20·4

* i.e $\frac{\text{m.d}}{\text{Mean}} \times 100$

A week after the lecture (*Slides* 3 *and* 4)

Group L		Group N	
Subject.	Marks	Subject	Marks
A	153	*P*	85
B	114	*Q*	94
C	107	*R*	75
D	107	*S*	55
E	102	*T*	45
F	118	*U*	81
G	82	*V*	67
Mean	111·9	Mean	71·7
m.d.	14·1	m d.	13·8

Coefficient of variation, 12·6.   Coefficient of variation, 19.

The effect of organised preperception can clearly be discerned in the differing variabilities of the groups. For the unlectured group N remains practically constant in this respect; whereas the group L displays a marked decrease in variability. It is important, for the theory of education, to

realise that systematic training tends to produce greater uniformity within a group. Group N had, of course, some training in the observation of the first two slides and in marking them, but such training was undirected by precise knowledge, and unsystematic as compared with that of group L. Experiments of this nature may serve to differentiate the relative values of class instruction and individual work especially for weaker pupils, since the decreased variability, as the figures shew, is brought about by levelling up the less able whilst the trained group as a whole and individually shew better results.

If we desire to compare the trained group with the untrained from the point of view of the relative difference made by preperception, we must resort to the statistical device of using as our unit the standard deviation of the groups For if one group yields more variable results than another this implies that variation in this group is easier than in the other. The crude figures in the above tables were converted into multiples of these units, yielding the following numbers when cleared of decimal points.

	Group L. Marks (in terms of σ)			Group N Marks (in terms of σ)	
Subject.	Slides 1 and 2.	Slides 3 and 4	Subject	Slides 1 and 2	Slides 3 and 4
A	60	85	*P*	39	47
B	34	64	*Q*	38	53
C	34	60	*R*	34	42
D	32	60	*S*	36	31
E	27	57	*T*	27	25
F	25	66	*U*	26	45
G	13	46	*V*	18	37
Mean	32	63	Mean	31	40

As the figures are now comparable, we shall not be far out in assuming that if group L had no lecture they, too, would have risen to an average of 40 instead of 63 Consequently 23 marks is the gain due to preperception, and to find the percentage gain we must start not from their original average mark, namely 32, but from 40. This is a gain of 57 5 per cent.

To put it otherwise, these figures shew that as a result of preperception the trained group is able to observe somewhat over one and a half times as much as the untrained group which implies, as pointed out previously, *that they are capable of so many more separate definite acts of attention.*

THE QUALITATIVE CONCLUSIONS

Having thus obtained a numerical estimate of the effects of preliminary knowledge in facilitating attention, it is time to consider the non-quantitative results which are, perhaps of more significance. In dealing with these use will be made of the records of the whole of the eighty subjects and of their introspections.

One of the most important differences made by preperception is very difficult to describe, as it is so essentially subjective The observer feels that his mental energy is being more effectively spent and this tends to make him feel more active. Such effective use of mental effort is accompanied by a distinct feeling of satisfaction, which seems to make the effort easier. Thus the person at one and the same time feels that he is more active with less effort. One of the N subjects put the matter in this way: "Lack of terms distinctly hindered my observation. I knew one technical term from reading Scott (tasset) and I always looked first to that part of the armour and had a *feeling of sureness* about this. Lack of terms hindered the mental separation of the armour into details; I could only remember each detail as soon as it was separated."

After the lecture the subjects of the L groups took the initiative and went out on a voyage of active exploration to discover the definite parts named; whereas previously the picture, as it were, had the initiative and the person was

passively trying to remember what it offered to him. Or, to vary the figure, just as an animal expecting the appearance of its prey is ready to spring with all its muscles pre-adapted for that purpose, so the person expecting to see certain details in a picture has his mind prepared ready to pounce upon them. Owing to this difference of attitude it frequently happened that the elaborate decoration, which was a feature of the last two slides, confused or baffled those who had no lecture, so that they lost the wood for the trees , but this never happened with the lectured group, who were able to dismiss the decoration with a name, and subsequently to remember its nature. These experiments, therefore, yield confirmation of the view that recollection of an observed visual fact may be based on purely verbal imagery without any sensorial image of a visual nature being present.[8]

It will be remembered that the subjects were asked, at the end of the experiment, to say how the lecture and the knowledge of terms had helped their perception of the picture. The records shew that the greatest help is given in supplying a plan for the observation, i e in making it more systematic and definite. Recognition becomes more rapid as a result of preperception, and more certain—no subject ever complained that he could not *see* a detail after the lecture was given. The lecture makes the details stand out from the background , as one subject said, "The ordinary parts were emphasised because one knew where to look for them. Without the lecture it was the curious or outstanding parts that were noticed." The latter part of this statement is open to challenge In the fourth slide the size of the 'lance rest,' when projected on to the screen, was about two inches in length and formed a conspicuous feature ; but it was hardly ever seen by a subject who did not know what it meant. In fact, it was this object which induced the writer, after the first set experiments, to insist on the declaration that everything that could be remem-

bered had been recorded, as it was difficult to persuade a person otherwise that he had missed so conspicuous a feature. In one slide, where the lance rest was inconspicuous owing to the ornamentation, it was never overlooked by those who knew what to look for. Finally, the absence of expected parts is immediately noticed; several subjects declaring that they needed only to look for missing parts after the lecture in order to take in the picture. One subject of an N group who had considerable artistic skill pointed out a curious difficulty. He said that he failed to observe the picture accurately, in detail, because he could not separate constructional from decorative lines owing to lack of preliminary knowledge of the structure of armour.

With regard to terminology it became evident that its chief use was to facilitate description, i.e. to make it more concise, more 'telescoped.' But this is not all, for frequently the mental image needed a word to fix it; that is to say, the terms formed 'pegs,' as one subject said, on which to 'hang' the detailed observations as they were made. Closely connected with this is the aid given in discriminating parts by the use of words. Words make the dissection of the suit into parts much easier. For this purpose it is essential that the names should be perfectly familiar. The following introspective record illustrates this: "Terms did not help me because I thought of the armour in terms of my own making. My method was to consider the parts of the body covered and *then* the name. Breast plate was 'breast plate' in my mind and 'cuirass' only by an effort of memory. This does not apply to 'greaves,' since I happen to know this term as a literary one."

We can best, perhaps, see the utility of terms by noticing what the subjects who had no lecture reported. "With terms," said one, "I would have tabulated all the possible parts into a generalised suit of armour and I should have

then gone through the given suit checking these off." In other words, lack of terms prevents generalisation. Another subject stated that "Lack of knowledge of structure and terms hindered me owing to lack of definite starting points, and definite systematisation in classifying parts. Also by necessitating the use of roundabout phrases, which was apt to turn my concentration on the visual image to concentration on the terms expressing it." Several others pointed out the necessity of putting their observations into language, whilst the slide was shewn, in order to recall the detail later Thus one particularly conscientious observer made the remark . "I could have mentioned several other points, but having no terms I was quite unable to express what I had noticed." He really meant that his memory image failed because he had no terms with which to retain it. Another remarked that he had a difficulty in retaining the relation of one part to another, and he thought that terms would have helped him in this respect Some few, however, denied all this and maintained that the absence of terms simply made their descriptions more clumsy. We are here probably dealing with ultimate differences in mental make-up. Having frequently had occasion to make use of the term 'mental image' in the present connection we shall now turn to the detailed study of such imagery.

CHAPTER V

MENTAL IMAGERY

Meaning of Imagination—Primary and Secondary Presentations—Varieties of Imagery—Images of Children—Imagery and Feeling—Meaning—Imagery and Learning

THE MEANING OF IMAGINATION

A GREAT difficulty in psychological study arises from the use of terms borrowed from everyday speech. The term imagination is terribly ambiguous, covering a variety of different processes only loosely connected, if at all, with one another. And even when applied to the same sort of process it is hard to disentangle the common element from the individual cases. Six different uses of the term have been distinguished by Dr I. A. Richards,[1] who for the purpose of literary criticism adopts the meaning given by Coleridge. The poet describes literary imagination as " a systematic and magical power . . . the sense of novelty and freshness with old and familiar objects ; a more than usual state of emotion, with more than usual order ; judgment ever awake and steady self-possession with enthusiasm and feeling profound and vehement." Coleridge also refers to " the power of reducing multitude into unity of effect, and modifying a series of thoughts by some one predominant thought or feeling." There is nothing, however, peculiar to the imagination in the latter characteristic which might be equally descriptive of a system of reasoning.

Common opinion has long recognised that imagination is not the peculiar possession of poets or literary men An architect, an engineer, a commander or a scientist may all be men of imagination in their own spheres; and we must endeavour to find out what features are common to all of them. One of the characters indicated above, namely novelty or freshness of conception, gives us a clue to what we are seeking. Strangely enough, Dr Richards omits one characteristic given by Coleridge which seems to me to be the key to the situation, or perhaps he rejects it as savouring of metaphysics. Coleridge[2] drew a distinction between the fancy and the imagination, the latter being "a repetition in the finite mind of the eternal act of creation in the infinite . . . it dissolves, diffuses, dissipates, in order to re-create; or where this process is rendered impossible, yet still at all events it struggles to idealise and unify." What is common to all varieties of imagination, properly so-called, is creativeness, or if we do not like this term, originality. It is not mere inventiveness or bringing together things or ideas not previously conjoined, nor merely novelty in the sense of something out of the ordinary, though freshness and novelty are always included The essential feature is originality of conception, without which there is no imagination. It is a unique style of conceiving, the man of imagination has an original style in his thoughts It is closely allied to genius and can no more be acquired than this can All the other emotional or intellectual features of the man of imagination are only ministers of the fundamental creative activity, and without it he may have any other excellence but not imagination

The earlier psychologists limited the term imagination to a faculty possessed by everybody, namely, the ability to evoke and use mental images. As this faculty is universal and not limited to persons of imagination, this feature of

mental processes will be discussed in the rest of the chapter. There are people, however, who whilst possessing images conduct their mental operations without much reference to them What they employ instead has been called 'imageless thought,' but as thinking in the proper sense of the term is distinct from image formation the name is not a very happy one

The images which are described in this chapter as secondary presentations have, as their precursors, some sensory data; and are known as "free images" or images detached from the primary presentations or sensations which gave them birth. There is, however, an intermediate stage of incubation, in which the images form an integral part of the sensations and are then known by the inappropriate name of "tied images." At this stage they are involved in the sensory presentations, and cannot be detached from them, as they have no independent existence. Thus a fire *looks* warm, especially on a cold day, even when we are too far away to experience any warmth. The warmth is a qualification of the *visual* appearance; the visual datum being complicated with a quality derived from another sensory source. When a very young child, who has tasted lumps of sugar, seizes a piece of salt and puts it into his mouth the ensuing shock of surprise helps him to free the image of sweetness from the visual appearance of sugar, from which it was not previously detached. In a similar fashion, when we look at the photograph of a person we know, auditory images of his voice and even the colour of his clothes are implicated in the appearance. The absence of colour in a cinema in no way detracts from the illusion of reality for the reason that its equivalent is implied in the scene itself. Everything in the sensory world is complicated in this way with images supplied from previous experience in dealing with the objects by means of the other senses. When we recognise anything as familiar,

the feeling of satisfaction which we get is largely due to this complication of the appearance with remnants of our former dealings with it. An incident which is completely forgotten may be immediately revived in memory on visiting the place where it had occurred, for the event has never been detached from the place, but is ' tied ' to it. A large part of our memories are fixed in this way to events, scenes or objects and are only recovered when these recur. The most interesting examples are found in the stimuli provided by words. Their character is so modified by the imagery bound up with them that many people hear in imagination the writer of a letter they are reading, and may even have a supporting image of his appearance Words as the stimuli to mental activity are very complicated things and the major part of their power is due to past experience.

The implied images tend, however, to become ' free ' in the course of development, thus freeing us in our reactions from the responses to sensory data alone. The effective stimulus, when we are reading or listening, is not the bare sight or sound, but the situation is extremely complicated. For this reason the idea of a ' stimulus ' of a purely objective kind, which has been borrowed from physiology is a most misleading term in psychology, and ought to be avoided where possible. To discover the effective stimulus when a person reads, for example, we need to know the general nature of his previous experiences, so as to find out what qualifications he introduces into the objective stimulus. What he responds to are not the bare symbols but a complicated situation which the symbols support. In an exactly similar fashion the effect of the environment on any individual cannot be estimated by examining the environment alone, for we need to know his previous history before we can say what the environment as a stimulus means to him The bearing of this on the heredity-environment problem has

previously been commented upon. We may now turn to consider the images when they have reached the stage of becoming freed from their earlier sensory supports.

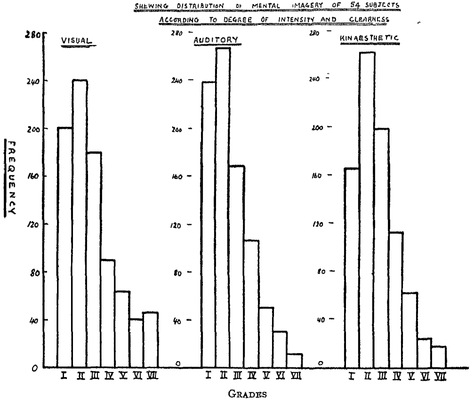
PRIMARY AND SECONDARY PRESENTATIONS

The scientific investigation of mental imagery received its initial impulse from Galton, who attempted to study mental contents by the comparative method.[3] He submitted a *questionnaire* to certain selected individuals of high intellectual standing containing questions framed so as to help their introspection. He asked them, for example, to state definitely what was in their minds when they made an attempt later in the day to recall the appearance of their breakfast-table. His questions were chosen so as to secure replies based on introspection with regard to clearness, vividness, stability, etc. of the objects appearing in the effort to remember. Galton started with the presupposition that visually evoked objects were more likely to occur and more important than others and consequently his questions were in the main about visual things. Dr Betts considerably improved the *questionnaire* method by asking an equivalent number of questions about objects belonging to the different sense modalities of sight, hearing, taste, touch, etc. so as to counter any undue emphasis on a particular sense.[4] His questions were more carefully chosen so as to guide introspection to very definite points, and his subjects, who were university students and teachers, were required to state whether the objects mentally recalled were as clear and distinct as their originals or only moderately distinct or whether, in fact, no object at all was present when the attempt at recall was made. A table of seven grades of vividness and distinctness was placed before the subjects, ranging from vividness which could not be dis-

tinguished from reality, to complete absence of vividness; and they were asked with reference to each mental object recalled to assign a number representing its grade. It will be convenient to call mental contents, which are aroused in the absence of the sense objects to which they refer, by the name of secondary objects or presentations.

As a result of Galton's inquiries it had become the custom to classify persons as visiles, audiles, tactiles, motiles, etc., according to the kind of content or secondary objects with which they were endowed and which they employed naturally in the mental processes of remembering, imagining, reasoning and the like. Dr Betts's study of 47 men and 96 women led him to the conclusion that few, if any, were absolutely incapable of evoking secondary objects belonging to every sphere of sense. He found that the three highest grades of vividness and clearness were distributed amongst his subjects in the following proportions: visual, 68 per cent, auditory, 65 per cent; cutaneous, 61 per cent, gustatory, 58 per cent; kinæsthetic, 57 per cent, organic, 55 per cent, olfactory, 50 per cent. The author of this book has found a very similar distribution amongst various groups of university graduates. These figures, shewing the occurrence in roughly equal numbers of the different modalities, afford no ground for the classification into ear-minded, eye-minded, etc, if by these terms we mean to designate the native constitution of various people. On the contrary, they shew that clear examples of the various modes are to be found in different people in approximately the same proportions. The like results have been obtained for school children between the ages of seven and fourteen years, amongst whom an especially high correlation was found between the occurrence of visual and auditory secondary objects. The diagram printed on the next page from data collected by the author shews the same thing by the similarity of the distribution for the three chief sorts of imagery.

It must be borne in mind that in all the cases so far considered we have been dealing with images voluntarily evoked; but the ability to recall these objects by an act of will is not a necessary indication of their ordinary use. Although it



Explanation —A *questionnaire* of 48 questions, 16 referring to each of the three kinds of imagery. Every subject, with a scale in front of him specifying the meaning to be attached to the grades, decided to which grade each image belonged Grade I is the highest degree of vividness and clearness

would be erroneous to speak of visual, auditory or other types of mentality in the sense of differences in native constitution with regard to secondary objects, there is no doubt that individuals do select and prefer to use different categories;

and if we merely intend to refer to this preference in actual use there is no harm in speaking of differences of type. The so-called 'pure types' are rare, if they exist at all; and there is reason to believe that the various modalities could, by practice, be kept approximately at the same level if that were desirable. Thus Professor Titchener states "My furniture of images is, perhaps, in better than average condition, because—fearing that, as one gets older, one tends also to become more and more verbal in type—I have made a point of renewing it by practice. I am now able, for instance, as I was able when I entered the class-room nearly twenty years ago, to lecture from any one of the three main cues. I can read off what I have to say from a memory manuscript; or I can follow the lead of my voice; or I can trust to the guidance of kinæsthesis, the anticipatory feel of the movements of articulation." [5]

This sort of evidence receives indirect support from the observation that the ability to evoke secondary objects belonging to any particular sphere of sense is not an influential factor in determining in what particular course of study a given individual will excel. Thus a person who can readily recall visual objects will not necessarily prefer geometry or drawing nor will an individual who can easily reproduce tones take to music. In fact it has been shewn statistically that there is an absence of correlation between the grades of voluntarily aroused secondary objects and success in college studies, either on the whole or in particular branches of learning.

By an obvious analogy secondary visual objects or presentations are called visual images, and by an extension of this comparison secondary objects of all categories are known as images of the primary presentations or objects. This terminology is part and parcel of current discourse and psychologists freely talk of auditory images, tactile images and so on. The student should bear in mind that all analogies are apt to be misleading and this one in particular has doubt-

ful implications. It is usually supposed that images differ from sense perceptions quantitatively only, and not qualitatively, and that this difference is mainly one of intensity. But it seems very difficult to believe that the gustatory image of sugar is merely a faint taste of sugar, for in that case a particularly strong image or a persistently repeated one would enable us to dispense with the real object, more especially in those cases where culinary art depends on the slightest suspicion of a flavour. Whoever derived satisfaction from an artificial rose by eking out its form with an image of its odour? Or who can cloy the hungry edge of appetite by bare imagination of a feast?

Unless the sense organ is stimulated there seems to me a qualitative difference between a mental image and a sensation. In this respect visual imagery seems to differ from all other varieties of secondary presentations, for it has been asserted that the intense mental picturing of a secondary colour results in the sensation of the complementary colour, and also that the image of one colour may interfere with the after sensations of others; which observations, if correct, would tend to shew that visual images exhaust the retina.

The total disparity between primary and secondary presentations is obvious to introspection, though the majority of psychologists seem unaware of the distinction. One very good observer has put the matter in an unimpeachable form. He says that to talk of reviving past mental experiences is not strictly correct, and gives as an instance his recollection of his morning's breakfast: "I have visual memory-images of the breakfast-room. . . . I have compound gustatory-tactile-thermal images of the taste of the porridge. . . . I have an olfactory image of the smell of the coffee and auditory images of the postman's knock. . . . Giving myself up to this memory experience, I *know* it is not exactly a reproduction, a renewal, a revival, a second edition of this morning's sense

experience. If I close my eyes and shade them, my field of vision, after a little while, becomes quite dark, and with the exception of the *Eigenlicht* of the retina, I cannot discover anything. Peep I may as much as I like, into the darkness, not the faintest trace of the white of the table-cloth, or the gold rim of the cups and saucers can I discover, not a vestige of a visual sensation. Nevertheless, I 'see' the breakfast-table quite plainly and vividly with the 'Mind's Eye,' as it is commonly expressed. That these memory-images are faint reproductions of the sensations, i e weak sensations, sensations of low intensity, is decidedly not true in my case, they are an experience, *sui generis* I consider myself a good visualiser. . . . If, then, revival or reproduction is spoken of, these terms must not be understood literally" This sound introspection of a competent observer is in refreshing contrast with the statements of untrained observers about their own mental imagery [6]

The best psychological definition of a mental image, i.e. a definition in terms of experience, is that given by Professor Colvin, namely, "that activity of consciousness in which an object of sensation is experienced as not immediately present to the senses." [7] Unless the experience carries with it the feeling that the primary object is absent and only the secondary present, the experience is not properly described as a mental image. This distinguishes the image from all such mental objects as perceptions, illusions, hallucinations, dreams, etc., for all of these "are stamped with the quality which functions for immediate sensory presence of the object." What it is that we really experience when a mental image is said to be present will be considered later, but meanwhile we may say that for all the modalities, except possibly vision and not certainly there, the use of the same terms for imagination and sensation, namely hearing, touching, etc., is unfortunate and only to be justified figuratively. The inability to discriminate

between hallucinations and normal mental imagery, and the mental confusion thereby entailed, is probably responsible for the ' eidetic image.' When the eyes are closed in a darkened room, and sometimes when they are open, hallucinatory visions are seen, brought about by pressure on the eyeballs, the slight stimulation due to lens adjustment, by changes in the convergence of the eyeball, etc. Under emotional tension as in delirium it is easier by slight stimulation to produce these hallucinations. Now, the same sort of phenomena are evident sometimes when one stares at a dark surface in daylight. If then a child is induced to look at a picture against a dark background and the picture is soon withdrawn he may be the victim of such hallucination so that he ' sees ' the picture after withdrawal. It is said that 60 per cent of all children investigated, between the ages of ten to fifteen, produce these ' eidetic images ' I have been present at such investigations and have been convinced that the whole operation is due to strong suggestion by the influence of the experimenter and the surrounding conditions, and the observations must be accepted with extreme caution.

When Galton sent his *questionnaire* in the first place to distinguished men of science one of them made the following most pertinent reply [8] " It is only by a figure of speech that I can describe my recollection of a scene as a ' mental image ' which I can ' see ' with my mind's eye. . . . I do not see it . . . any more than a man sees the thousand lines of Sophocles which under due pressure he is ready to repeat." He received, to his great astonishment, the same sort of confession from several others, and it is difficult to see why he should have been surprised by such accurate observations. He also tried the experiment of suddenly accosting some person with the statement, " I want to tell you about a boat," and then inquiring what mental image was aroused by the word ' boat.' One of his victims, a young lady, apparently anxious to pay

him back in his own coin, assured him, presumably without a smile, that " she immediately saw the image of a rather large boat pushing off from the shore, and that it was full of ladies and gentlemen, the ladies being dressed in white and blue." Another person, a philosopher this time, told him that the word ' boat ' aroused no definite image as he had purposely held his mind in suspense. From these and a large number of similar observations Galton concluded that scientific men and other thinkers have feeble powers of visual representation, the faculty being starved by disuse. He appears to have been too ready to accept the introspections of the young lady and some schoolboys at their face value, whilst rejecting that of more competent observers. We shall see reason in the sequel to doubt the accuracy of the introspections of untrained observers. What makes one hesitate more than ever in accepting such statements is the repeated assertion of persons who claim to have very clear and vivid visual images that they could draw from them if only they knew how to draw, whereas artists who *can* draw assert that their " imagery is so clear that if they had been unable to draw they would have unhesitatingly said that they could draw from it." This, again, shews that imagery is of a different order of reality from sensations. Much harm has been done to psychology by Galton's unwariness in dealing with his evidence about mental imagery and his mistakes have been handed on unthinkingly and are widely accepted as irrefutably established facts

THE VARIETIES OF IMAGERY

Enough has been said to indicate that most of the primary objects of sense have their counterparts in the secondary presentations of imagination. Now, an integral feature of every primary presentation is some muscular movement, thus in seeing the eyes are adjusted, in tasting the tongue is

moved, in touch the muscles of the hand are brought into play, and so on with every sensory experience. In addition the muscular or kinæsthetic sense, due to strains and stresses in the muscles and tendons, and pressures on the joint surfaces brought about by gross movements of the limbs, plays a predominant part in all our activities, adding their quota to the tale of secondary presentations.

Kinæsthetic or motor imagery has been widely investigated and it is convenient to have terms to distinguish its varieties. We shall use the word *somamotor* to designate the imagery of gross trunk, limb or head movements; *manumotor* for those of the hand; *oculomotor* for eye movements; and *vocimotor* for images of the movements of the vocal organs. Although the majority of psychologists lay great stress on the importance of kinæsthetic imagery in mental processes there is a growing body of opinion that what are called motor images are, in reality, incipient motor sensations. Thus the attempt to recall words by vocimotor images is said to consist really of very slight movements of articulation definitely localised in the lips, tongue, larynx, etc. Again the effort to recall the movements of running or a stroke at tennis whilst sitting comfortably in one's chair may result in the feeble reinstatement of actual muscle, tendon and joint sensations instead of somamotor images Whether this is the whole of what is meant by motor imagery, or not, there is little doubt that careful introspection does reveal slight resident sensations in the various organs when kinæsthetic imagery alone is said to occur.

Despite assertions to the contrary by those who maintain that they experience secondary presentations with the same fullness of detail as primary presentations there seems to be little doubt that all such recall is more or less sketchy and symbolic. Those features only are reinstated which are relevant to the particular moment of recall, and the absence

of the rest is usually not noticed because our attention is otherwise engaged. This is especially true of kinæsthetic imagery where a bare sketch of a movement is adequate for our purposes and even the sketch may be symbolic suggesting the movement rather than copying it

The various modalities of imagery do not occur in isolation and it is a matter of some difficulty to distinguish between motor and visual imagery. Words may be recalled in vocimotor, visual or manumotor terms, and bodily movements as visual or somamotor images, and it may be that in all cases all the varieties are mutually involved. Nevertheless, Professor Pear asserts that excellence in bodily skill may rest on a unique development of kinæsthetic imagery distinct from visual or all other types Persons endowed with imagery of this sort would perceive and remember new movements, from the outset, in purely kinæsthetic terms It is conceivable that if they could elaborate their particular talent in motor symbols new concepts could arise and they could communicate their skill to others in motor terms. The vogue of gymnastics, dancing and eurhythmics in schools would thereby be facilitated and a new mimetic art might be evolved [9]

All such views rest on an assumption which is palpably incorrect, namely that secondary presentations can exist apart from their functioning or activity in much the same way that primary objects have an independent existence. Now images are not stored up ready to be recalled when required. I can produce the signature of my name at will, but it would be absurd to suppose that somewhere in my muscles the kinæsthetic images are kept ready waiting to make their appearance like actors in the wings of a stage. There is no kinæsthetic image apart from its use When I say that I have such an image all I mean is that, given the appropriate stimulus, I can act in a particular way, i e. write. Nothing further ought to be meant when I say I have a visual or auditory or

any other sort of image. All these only come into being when some situation arises in which I must respond in a definite fashion either visually or otherwise. Thus if I am planning to lay out flower-beds in a garden I can do so easily if I walk about the garden or have a sketch of it in front of me; failing this, a visual image of the garden is of service. It is as well to note, however, that I can do my planning equally well if I know the size of the garden and its shape in somamotor terms or in vocimotor imagery or even in words apart from any of these.

There is one variety of imagery not yet touched upon, namely organic, i.e. secondary presentations corresponding to organic sensations such as hunger, thirst and all other primary sensations dependent on particular bodily conditions. It is doubtful whether such so-called organic images are not in all cases real sensations of minimum intensity. The direction of the attention to any part of the body is likely to yield a sensation in that part, which may be interpreted to mean that sensations are continually occurring from all parts of the body but are usually ignored either because they are too faint or because of their unimportance The mental importance of organic sensations lies in their relation to our emotional states which are among their most prominent causes; and, as we shall see later, a confusion is apt to arise between such states and what is erroneously regarded as imagery.

THE IMAGES OF CHILDREN

It is universally believed that the imagery of children is more vivid than that of adults, but after what has been said this can only mean that they make more use of their images. The only certain way of discovering a mental image is by introspection. All investigations which rely on indirect

means, such as presenting material to be learnt by the eye or the ear alone and inferring the images from the correctness of the learning are, as the sequel will shew, erroneous Binet's method [10] of getting direct introspection is the correct procedure, but it is a difficult and treacherous one where children are concerned and the results must be accepted with the greatest reserve As the result of a study of the introspection of school children between the ages of seven and a half years to fourteen and a half years Dr Rusk [11] maintains that imagery between these ages is particularly rich and detailed, consisting of all varieties · auditory, visual, tactual, kinæsthetic, organic, etc. In some cases the imagery was said to be so vivid as to obliterate whatever was in the field of perception, producing an abstracted look due to concentration on the secondary objects It was also observed that the children themselves are frequently projected into their own imagery, so that they observe themselves doing things as though they were spectators of the scene, just as in a dream. This feature of self-projection was noticed in the children of all ages. Those of the most fertile imagery, however, were by no means those of the highest school intelligence. Other observers, too, have found that the correlations between vivid and clear visual and auditory imagery and school intelligence are low, or it may be negative. A pupil may have clear and correct images of the illustrations of a lesson, for instance, and yet have learnt very little if he fails to grasp the underlying meaning and relations. As far as school studies are concerned vivid mental imagery may be detrimental, or rather it bears no relation to the effectiveness of the mental processes which it accompanies. Even in the lower mental processes such as sensory discrimination of colours, musical tones and pitch, shapes, etc. imagery is helpful only to a small degree, less so in the case of auditory than visual images The value of sense training in schools, rightly urged by educational

reformers such as Rousseau and Pestalozzi in opposition to the reliance on words alone, rests on its intrinsic nature and its assistance in mental development, rather than on the cultivation of mental imagery. Without the sensory basis the thought processes could not begin to work, as was shewn in the case of the wild boy of Aveyron. But the ability to evoke images by an act of will is no index to the extent to which images are used in the various thought processes. It has been shewn, for instance, by taking records of the reaction-times, that many persons appreciate the meaning of a word or phrase in a shorter time than they take to recall the corresponding image.

There is evidence to prove that the vividness and clearness of imagery can be improved by practice. Whistler's master trained his pupils to note carefully the details of landscapes which they were subsequently to paint, and the efficacy of the method was certified by a French Government Commission which shewed that as a result of the training the artists could remember and reproduce the complicated pattern and colour of a Persian rug in its absence after studying it carefully for a short time.

IMAGERY AND FEELING

The artists referred to reproduced the pattern so that, as the published colour reproductions demonstrate, it was difficult to believe that they were not painting from the primary object. But this is not to say that they were necessarily painting from a visual image. For it would be quite possible to reproduce the shape and colour of the rug by means of kinæsthetic and verbal imagery. If I remember that the colour of an object is bottle-green and its shape that of a lozenge I do not need a visual image in order to reproduce it.

Suppose ten straight lines of different lengths are drawn crossing at random so as to make a meaningless figure, and exposed for five seconds, and a person is asked to reproduce it afterwards. Professor Piéron [12] who devised this experiment found that, on the average, fifteen such exposures, each followed by an attempt at reproduction, were sufficient for correct recall, i.e. for recall of the direction, approximate length and angle of crossings of all the lines. Now a photographic visual image of the figure is quite out of the question for this implies that all parts of the figure are seen at once, but in actual fact only a small portion is focused and the rest is vague The eye must actively explore and fixate the various portions before the whole is seen clearly, so that the sensory data for a considerable quantity of kinæsthetic imagery are present

We should expect then that kinæsthetic imagery would play a considerable part in memorising the figure and this is what Piéron found. His subjects relied largely on motor imagery, in calling up the angles for instance they had kinæsthetic impressions of different movements. He also noticed that there was a certain amount of intellectual reconstruction of the figure.

The author of this book has repeated the experiments on over twenty university graduates, who had been trained to introspect, and found that the average number of exposures for correct reproduction was thirteen. The subjects were, of course, left free to choose their own methods of memorising. In only one case was there a distinct visual image and all the subjects built up the figure piecemeal. Where an attempt was made to get a visual picture of the whole it soon proved ineffective and was abandoned in favour of a series of kinæsthetic efforts. At first sight the figure presents the appearance of a confused jumble of intersecting lines entirely devoid of meaning. The instructive part of the experiment lies in

the discovery that the subjects, without exception, make attempts, more or less successful to read meaning into the chaos, to intellectualise it by the help of language or verbal imagery. Visual images, even if they are used, which is very rare, do not aid recall and the reproduction is only effected when the figure is made significant. The real stimulus is not the confusing appearance but a meaning which the subject extracts from it. for the mind has an innate tendency to read meanings into its presentations and the reaction is made to these meanings and not to the bare stimuli. Such meanings were almost entirely embodied in language. Thus one subject, who after thirteen exposures was able to reproduce the figure correctly an hour later, started with kinæsthetic images which gradually disappeared and were replaced entirely by language. He analysed the chaotic drawing into the following formula: "Cross, telegraph pole, parallelism, point, parallelism, inequality," which being remembered *verbally* enabled him to retain the figure.

Now the meaning of an impression can be retained in yet another way which is of the first importance for the understanding of mental imagery. It is very questionable whether olfactory images have any independent existence apart from present sensations. Yet Shelley wrote

> "Odours, when sweet violets sicken,
> Live within the sense they quicken."

The lyric in which these lines occur is suffused with delicate feeling, and what "vibrated in the memory" of Shelley was doubtless the undying emotional tone with which his soul responded to beautiful objects. Such emotional reawakening is frequently mistaken for imagery. The organic resonance which accompanies recollection, due to changed heart beat, disturbed respiration, intestinal movements, etc., is sufficient to account for the air of reality which memory

yields giving a secondary presentation the tang of an object present to the senses. It takes very close introspective observation to distinguish emotional states and the organic response which is their expression from sensory imagery, so that the evidence of untrained persons with regard to their mental furniture is almost worthless. Such a careful observer as Professor Colvin [13] as the result of the study of his own imagery concluded that what passes for an auditory image is frequently a mixture of kinæsthetic and other sensations. He says that the chief factors of his own auditory images consist of "various accompanying sensory phenomena, in part those due to motor adjustment and in part those coming from bodily sensations in connection with the emotional accompaniments of tones"

A passing whiff of hay carried by the breeze will instantly reinstate scenes of our childhood or a pleasant summer vacation. The pleasure and intimacy of such recollection is almost wholly due to the revival of organic sensations and emotions which odours are peculiarly fitted to arouse. So the snows of yesteryear may live in our memory solely by reviving the feelings which they once accompanied and independently of any visual imagery. When, for any reason, the same emotional tone is aroused in us we are apt to get the feeling of living through the original sensory experience The present author is frequently surprised to find himself imagining he is at sea when passing a kitchen door and is able to trace the illusion to the sickly odour of peeled potatoes which he endured on a voyage long ago. He is thus able to endorse Professor Piéron's acute observations on the precautions necessary to be made in studying images, which must be quoted in the original.[14] "Il peut même arriver qu'une évocation purement affective soit prise pour une évocation proprement visuelle, ainsi, lorsqu'on évoque un objet sombre ou clair, on croit parfois y réussir alors qu'on éprouve des impressions, des

sentiments, en rapport avec lui, sans qu'une image clair on sombre apparaisse le moins du monde. On doit prendre garde aux illusions d'introspection."

In the laudable attempt which is now being made to cultivate literary appreciation in schools much attention is paid to the stimulation of imagery. Lessons are given in which the pupils are asked to concentrate on the images whilst a poem is read to them. No doubt the enjoyment of the piece is thereby enhanced in literature where the meaning is contained in the imagery or forms a large part of it. But, on the other hand, concrete and distinct imagery may prove a hindrance when the images are not essential to the thought but merely enrich or develop it. Experience has shewn that poetry containing many pictures is not necessarily easier for a pupil to grasp than a piece devoid of images. Moreover, the enjoyment of literature and its appreciation come largely from the thoughts which call forth heightened feeling when expressed in appropriate rhythm; and although a large amount of imagery may be present, it is usually only a subsidiary feature of æsthetic taste.[15]

MEANING

Much discussion has centred round the question of the occurrence of imageless thought In one sense all thought is imageless for it is concerned with propositions or meanings and not with bare subjects or predicates. Images are simply part of the material supplying the data which thought manipulates. Just as written language consisted at first of pictures becoming in the course of time more and more symbolic, so thought in its early stages may need the support of sensory images, gradually replaced by verbal imagery which in its turn may yield place to meanings alone, in which the

sensory basis is almost entirely swamped Similarly the child in the kindergarten is guided to his number concept by means of sticks and balls, whilst to the astronomer manipulating his symbols the realities signified may be as remote from his sensations as an undiscovered planet. As soon as meanings become clearly defined and ideas proceed smoothly images tend to disappear from the focus of consciousness. They reappear again only when any impediment occurs, obstructing the free flow of thought, so that as the author of this book has shewn " any delay or conflict in consciousness is a favourable condition for arousing a relevant mental image, that is one that will in some way help towards a cessation of the conflict." [16]

When images are present in thinking or other mental processes they function as symbols only. For this reason it is by no means necessary that they should be detailed copies of sensory presentations and in fact too much detail would often be a positive hindrance. It frequently happens that when we think we are able to recall a man's features, say, with great exactness, we are astonished to find on being asked that we do not know whether he has a moustache or not. What is recalled in these cases may be the barest symbolic indication of a face or a typical expression. In like manner too with auditory images; when we think we can recall a friend's voice we may find that there are no defined vowels or consonants before us but simply a suggestion of the quality of voice or enunciation Only these latter things interest us, unless we happen to be phoneticians, and what is resuscitated is confined to what we are mainly interested in.

Some people can recall the colour of an object without its specific shape or even the gloss without either, provided that they are interested in these alone. As was previously hinted at, a person's confidence in his ability to evoke a mental image in

all its concrete setting is due to the revival of certain emotional characters. Again, in all perception, in addition to the sensory experience involved there are certain specific conscious attitudes distinct from kinæsthetic sensations. Such attitudes add new content of a non-sensory kind to our perceptions and these non-sensory elements may be sufficient for recall of an imageless nature. In memory and imagination such attitudes and emotional experiences may form the tissue of our thinking, the sensory elements being subsidiary and irrelevant. Imageless thought in this sense is not only possible, but of frequent occurrence amongst those who, by careless introspection, confuse these experiences with sensory images. It is such attitudes, emotional revivals and other non-sensory mental material which play the chief part in imaginative literature, and not merely the sensory revivals which flash upon the inward eye

It was said above that thought is concerned with meanings, of which images are simply the vehicles or carriers. There is, however, a persistent attempt amongst psychologists to identify imagery and meaning. Whilst some urge that imagery is but the stimulus and meaning the response; or to put it in another way, that image is the structure whilst meaning is the function, others maintain that the image is itself all that there is in what is meant by meaning. Nobody is more competent or has a greater claim to respect when introspective matters are at issue than Professor Titchener, who goes so far as to state that the meaning of *meaning* is itself an image. Here are his introspective findings. "I see meaning as the blue-grey tip of a kind of scoop, which has a bit of yellow above it (probably a part of the handle), and which is just digging into a dark mass of what appears to be plastic material. I was educated on classical lines; and it is conceivable that this picture is an echo of the oft-repeated admonition to 'dig out the meaning of some passage of Greek or Latin.'" [17] As

Professor Titchener has told us that he took great pains to keep his visual images up to the mark by constant practice, he would inevitably find these specks of the past brought to light by introspection. But to regard them as *meaning* is like the attempt to study the constitution of light by paying attention to the motes in the sunbeam which the rays make visible.

Driven from the stronghold of visual and auditory phenomena, the sensationalists, who regard meaning as exclusively sensory or imaginal in content, may still take refuge in kinæsthetic images. This, in fact, is what is frequently done The meaning of a physical object is said to be constituted by the motor adjustment made towards it When a dog cringes at the sight of a whip or jumps and barks joyfully at the sound of his master's whistle, the cringing and the frisking adjustments are thought to be the whole of what is meant to the animal by the whip and the whistle, nothing more Meaning, in short, is movement, and the more complex meanings involve simply finer and more delicate responses. The behaviourists assert indeed that the movements must be primary presentations overt or incipient so that the meaning of an equation, say, consists simply of the manumotor and vocimotor reactions which are suggested by it. No new element is involved when the reactions are taken to be not primary movement, but secondary kinæsthetic imagery, for meaning is still said to be adjustment.

The enthusiastic advocates of handwork as an educational instrument have been only too ready to adopt the behaviouristic standpoint as their psychological theory instead of taking their stand on the intrinsic importance of an all round development of mind and body. Manual work does not need the support of erroneous doctrines, but may justify itself as an educational organon on the ground of its social and artistic significance satisfying urgent concrete needs which abstract scholastic traditions completely overlooked or suppressed.

Now a fatal objection to the theory which regards meaning as adjustment lies in the fact that we adjust ourselves to meaning and not to impressions. To use a witty illustration devised for a totally different purpose. Suppose a behaviourist confronted first by a bear in a modern zoological garden terrace and then by a bear at large, to the former he offers a bun to the latter a clean pair of heels. Will he now undertake to explain in terms of behaviour alone his very different responses in the two cases? Only by the knowledge that the free and the confined bear *mean* totally different things can the vastly different adjustments be explained, not *vice versa*. As the illustration shews, it is to the meaning of a total configuration that we react and not to detached portions of it whether sensations, images or what not. Meaning is prior and psychologically supreme. Experimental work on word asssociations has proved that the purpose to respond in a definite way is sufficient to produce specific reactions when the subject is totally unable to detect any image, and when he is barely conscious of the stimulus word but only of its general meaning. Allowing for justifiable exaggeration as a counterblast to sensationalism, we may adopt the position that mind deals only with meanings; that "we always see meaning as we look, think of meaning when we act. Apparently we are never distinctly conscious of anything but meanings." [18]

The researches of Binet in France, Woodworth in America and the Austrian school of psychologists have given the deathblow to the crude sensationalism which regarded impressions, whether primary or secondary, as adequate to explain mental structure and function, and meaning as a mysterious and troublesome result of their interaction, to be explained away. On its structural side we previously called this view atomism, since it conceived of mental life as a congeries of elements held together by associative bonds. Meaning was a new

element superadded to the complex when it began to function. But the whole notion of mental elements is artificial and invalid. Mental life is an organic unity and all parts are what they are by virtue of the living whole. Meaning is not a new element added to pre-existing elements, but permeates the whole structure which is steeped and dyed in it, or rather without which it has no vitality.[19] A good analogue of mental life is to be found in a living language where the play of meanings is the informing spirit of the whole, whilst sentences, parts of speech, words *et hoc genus omne* are the disarticulated parts of the skeleton separated by grammatical anatomists. We may as reasonably expect to construct a language with these dry bones as to exhibit mental life as an association of impressions plus meaning The direct method of teaching modern languages in schools, apart from its infinitely greater effectiveness in practice, is founded on the sound psychological instinct that without life there can be no feeling and that a feeling for language is of the very essence of language.

There are certain features of the mental life which the researches of the Austrian school have emphasised and which no account of meaning can afford to overlook. The method of investigation is remarkably simple.

A person is asked to perform a simple operation, such as to decide on the heavier of two similar looking weights, or to write down the first half a dozen words that occur to him, or to react to a word that is shewn to him by some associated word, either made ' freely ' or under some constraint such as that of whole to part (e.g. chair-leg), or to answer ' yes ' or ' no ' to some simple statement read to him, or to give his opinion on some doubtful point and so on. Immediately after the reaction is made or the opinion given, or in some cases during the course of making up his mind, the subject is asked to give as complete an introspective account as

possible of what was in his mind during the experiment and aided his judgment or thinking.[20] The most highly trained introspective psychologists have been the subjects of these experiments. What they found was that in addition to sensations, images, ideas, volitions, etc. certain conscious attitudes or postures were present, distinct from all these. In describing such attitudes the observer has, of course, to explain them in terms of ideas, feelings, etc., but these are stated not to be present in the experience itself *as it is felt*. Examples of such attitudes of a cognitive and conative kind are doubt, certainty, hesitation, conviction, awareness of a relation, realisation of the task, etc. etc., all given in a flash of consciousness and felt as an undiscriminated whole. Sometimes the attitudes are affectively toned and at others they are neutral, but in either case, as experienced, they are peculiar modifications of consciousness totally disparate with imaginal contents. Their intimate nature appears to suggest that they must be peculiarly subjective attitudes, which, like the elementary feelings are unanalysable. The importance of such attitudes is gradually being recognised in literary criticism.

IMAGERY AND LEARNING

At first sight it might appear that the mode of presentation would determine the particular kind of imagery used in recall. Thus material presented to a subject visually or aurally might be expected to be reproduced by visual or auditory imagery and so with the other varieties. This obvious assumption is frequently made by teachers in devising methods of presentation of their material in the belief that they are thus able to influence the mode of learning and remembering. In this respect teachers have been misled by

psychologists who ignore or deny individual preference or selection. Now a pupil is never the passive recipient of impressions but always exerts selective activity on what is presented to him. In particular, visual impressions are not registered passively as on a photographic plate, but what is visually retained is, as we saw above, influenced by what the subject is interested in and definitely attends to. Professor Meumann and others have demonstrated that the images of reproduced words are primarily those which the subject prefers to use, and are only secondarily influenced by the mode of presentation. When material is presented aurally to subjects whose preference is for visual imagery the reproduction is made in terms of the latter. The mistaken view here alluded to is widely prevalent not only amongst psychologists and teachers but generally. Much literary criticism rests on the assumption that it is possible to get an insight into an author's imagery and mode of composition by examining his written productions. But this is wide of the mark. One of the chief delights of Heine's poetry is its haunting musical lilt which is quite unreproducible in any translation. Yet Heine himself denied that he relied on the sound of the words, and insisted that it was the sight of the words and constructions which was his main help in composing. When he had become almost blind so that he was forced to dictate his poetry he complained of the difficulty, thus: "Our language is adapted to the eye; it is plastic, and as regards rhyme, not only the sound, but also the manner of writing has its influence. . . . The German must, in my opinion, see or have practically formed (plastisch) before him what he colloquially creates. Verses which one finishes in one's head are easier to dictate than prose, and yet I could not do that." [21] If Heine could not rely on his auditory imagery in composing who can?

G. H. Lewes reported, indeed, that Dickens told him that

"every word uttered by his characters was distinctly *heard* by him before it was written down," and, assuming the correctness of this, he very rightly attributes it to hallucination. Forster, the biographer of Dickens, rejects with indignation the hallucinatory theory of his composition, but admits that it might possibly have occurred during periods when he was overwrought and ill. When he was suffering under the severest trial of his life he wrote to Forster that he thought "it was a wonderful testimony to my being made for my art, that when, in the midst of this trouble and pain, I sit down to my book, some beneficent power shews it all to me, and tempts me to be interested, and I don't invent it—really do not—*but see it*, and write it down" [22] The well-known hypersentimentality of Dickens and his extraordinary sympathy with all his creations may possibly have provided the affective background for most of what he "saw", he, like others, confusing feelings with images, unless his jarred nerves produced true hallucinations.

A similar doubt is suggested by the following account of Whistler's method of studying his Nocturnes.[23] "We had left the studio after dusk . . . when he suddenly stopped, and pointed to a group of buildings in the distance . . . shewing golden lights through the gathering twilight. . . . After a long pause he turned and walked back a few yards; then, with his back to the scene at which I was looking, he said, 'Now, see if I have learned it,' and repeated a full description of the scene, even as one might repeat a poem one had learned by heart." Who will be prepared to say after this description whether Whistler relied on visual or verbal imagery in painting?

An investigation into the effect of the mode of presentation upon the process of learning has confirmed these views and extended their scope.[24] Lists of words and meaningless syllables, presented in diverse ways, were learnt by various

students trained in introspection whose normal imagery was of different kinds. The forms of presentations were variously combined. In some cases, for instance, the words were exposed visually and the subject repeated them aloud, or he saw them and inhibited the tendency to repeat whilst the experimenter said them aloud, sometimes the words were read to the subject who wrote them and saw his writing, or wrote them with his eyes shut, and so on in various other ways. The introspections revealed the fact that for learning this sort of material it is difficult, if not impossible, to inhibit verbal imagery whatever the form of presentation, and the attempt to do so intensifies auditory imagery. With combined visual and aural stimuli the subject attends to one only, not to both When words are recalled which have been read aloud by the experimenter, if any auditory image is present, it is that of the subject's own voice not that of the experimenter Subjects whose normal imagery was vocimotor used this type of image when the presentation was auditory or visual. In general, the particular mode of presentation did not determine the modality of the imagery employed by the subject either in learning or recall. As far as imagery is concerned the learning process depends much more on the mental make-up of the learner than on the method by which he is taught. Where, however, there is a difficulty in remembering, so that the words do not readily come, the imagery corresponding to the mode of presentation may be aroused. A clearer instance of the importance of individual differences in learning would be hard to find.

Combined with the specific images of the words, recall is often aided by a schema of a visual or kinæsthetic kind, or sometimes by a rhythmic schema of a vocimotor nature in which no definite words need be present.

The close relation between bodily skill and kinæsthetic or motor imagery was referred to above. In all such tasks

as handwriting, typing, playing on instruments, speech exercises and singing the importance of motor imagery is evident. The methods employed in sport might, with advantage, be used for acquiring skill generally. In training for games considerable use is made of the strain-sensations in the muscular system. The athlete tries to 'feel' the movements as he makes them. At first he observes the motions by watching others, but he acquires skill only when he gets the same strain sensations in his own muscles. All unnecessary movements are eliminated, and the essential components welded together by their 'feel' Similarly in learning phonetics, the pupil's attention should first be directed to the lip and other movements of the teacher or by diagram. But soon his attention should be directed to his own actual motor sensations, which he should be required to reproduce by constant drill, so that the feel of the movements is fixed in the neuro-muscular system and becomes automatic [26] The method by which skill of various kinds is attained will next claim our attention and will be discussed in the chapter on habit-formation.

CHAPTER VI

HABIT FORMATION

Nature of Habit—Rôle of Impulse—Form of Progress—Importance of Purpose—Improvement in Retentiveness—Neural Basis of Habit—Habit and Instinct

THE NATURE OF HABIT

In the realm of habit the effects of education, in the widest sense, are enduring Any persistent effort repeated over a sufficiently prolonged period, with a definite purpose, will produce permanent effects on the intellectual and bodily activities of the individual. When, for example, a child is learning to talk, he takes a keen delight in trying, repeatedly, to produce the sounds which he hears, and in the course of time reflects accurately the particular vowels and accent current in his environment No doubt, as he progresses, some modification may be produced by subconscious assimilation, without any apparent effort; but as the child is naturally imitative of his elders he tries, with more or less persistence, to repeat whatever he hears them say An accent or any trick of speech acquired in this way is notoriously permanent, and though it may be masked by subsequent education it is always beneath the surface ready to spring into action when for any reason self-control is weak. In a similar fashion, the student of mathematics gets habituated to respond automatically to certain frequently occurring symbols and forms of

expression, and the student of biology to facts of organic life with a train of evolutionary ideas which arise spontaneously. In all these instances it is obvious that, although the finished reactions are effortless, or nearly so, the actual progress to this desired end was marked by a succession of trials and failures; and only by holding fast to the correct modes of acting and thinking was the final achievement possible. The method of trial and error, by itself, however, is incapable of giving rise to any habitual mode of conduct, as the facts adduced later will abundantly shew

In forming a habit the individual, as it were, saves future effort by accumulating acts of volition in the form of a permanent investment, on the interest of which he may live for the rest of his days This characteristic feature of habit by virtue of which the effort ceases when its purpose has been finally accomplished, is the foundation both of the utility and danger of habit-formation Unless the effects of practice were to make our conduct and thinking more facile in certain directions, progress along such paths would be ruled out. It has been said that we rise on stepping-stones of our dead selves, but though this belief may have a certain ethical significance, it is nevertheless a psychological blunder. When a man is trying to solve a problem in mathematics, for instance, he will not be able to proceed far unless he is so grounded in all the elementary processes that he can safely trust to his habits, unless, that is, they are so much alive that they need no present effort on his part to make them active; and so he is able to devote all his attention to the problem itself.

But there is another side to the picture; for extreme habituation is often a bar to progress, especially where ideas are limited. The constant repetition of the same thoughts in the same grooves makes it difficult to diverge from them and strike out into new directions. So much is this the case, that in the great majority of persons escape is impossible, for

they are incapable of making the strong and persistent effort which is necessary. Only the fortunate few can break through the hard crust of custom. Of others it may be said

> "The moving finger writes and having writ
> Moves on, nor all your piety nor wit
> Can lure it back to cancel half a line
> Nor all your tears wash out a word of it"

In addition to habits of thought and of action there are also so-called habits of will, by which is meant the ready carrying out in practice of a resolution or purpose when once it has been firmly implanted, such as the habit of punctuality. Closely allied with the last-named are such virtues as honesty, veracity, etc., for the virtuous man has so habituated himself by steady purpose that action in opposition to the virtue gets no lodgment in his life. In so far as moral training is effective, moral action becomes action in the line of least resistance. Plato correctly believed that all virtues except wisdom could be acquired habitually, for, he said, "the other so-called virtues seem to be akin to bodily qualities, for even when they are not originally innate they can be implanted by habit and exercise" [1]

A considerable amount of experimental work has been performed in order to study the growth of habits and, as might be expected, most of this has been devoted to the study of habits of action as these are most easily observed. It should be borne in mind, however, that much of what is said in this chapter about bodily habits applies, *mutatis mutandis*, to the other categories of habit.

THE RÔLE OF IMPULSE

A bodily habit is the expression in terms of muscular movements of the improvement, acquired by practice, in the

facility of adapting oneself to similarly recurring conditions. Thus, in learning to swim, or to write, or to act in any other way, the diffuse, unco-ordinated and awkward motions of the tyro are gradually replaced by the restricted, co-ordinated and facile movements of the adept, carried out nearly automatically as a response to similar circumstances. The unerring mechanical precision of such acts is evident from the fact that a rubber stamp is often used as a substitute for a man's signature, and as far as the outline is concerned there is nothing to choose between them. In fact a close consideration will shew that in other respects they are similar, for whether a man stamps or signs his name, he uses a tool to carry out his purpose; only in the one case the tool is made of rubber, in the other of muscle and nerve. Fully fledged bodily and intellectual habits thus tend ultimately to become the mechanisms or tools by means of which our wider aims are accomplished with dexterity and celerity.

Is then, the study of habit-formation to be considered merely as a branch of physiological mechanics? This question raises the important issue as to whether a habit is to be regarded as an acquired impulse to activity; whether in brief education in skilled activities can create new springs of conduct. Now an impulse is the driving force or prompting to vital activity, and it is necessary to see whether such a 'drive' can be acquired by experience, or whether experience is limited to giving new directions to pre-existing impulses.

The overwhelming urgency of vital impulses is best discerned in those cases where, for any reason, their free expression is thwarted or hindered. Human beings, together with the higher animals, have an impulse or propensity to communicate with their fellows by vocal sounds, and this impulse normally finds satisfaction so readily that its overbearing force is seldom realised. It must be remembered, however, as was pointed out in an earlier chapter, that the impulse,

at the outset, is of the vaguest and only acquires definite direction as the result of experience. Prior to her education the blind deaf-mute Helen Keller had no means of expressing this instinct except by a very limited number of artificial signs which she had herself invented. "Meanwhile," she writes,[2] "the desire to express myself grew. The few signs I used became less and less adequate, and my failures to make myself understood were invariably followed by outbursts of passion I felt as if invisible hands were holding me, and I made frantic efforts to free myself. I struggled—not that struggling helped matters, but the spirit of resistance was strong within me, I generally broke down in tears and physical exhaustion. . . . After awhile the need of some means of communication became so urgent that these outbursts occurred daily, sometimes hourly." The urgency of the instinctive impulse was obstructed in this case by lack of sensory aids, but the interference with any innate impulse by any method will produce similar results.

A couple of further instances may be given to shew the strength of an inborn tendency, and the difficulty of diverting it into other than certain channels. Handel's father, a surgeon, regarded music as a degrading pursuit, or, at best an idle amusement; and "he strove to stifle in every way the alarming symptoms of musical genius which appeared in his son almost in infancy, while he refused even to send the child to school lest there, among other things, he should also learn his notes." [3] Nevertheless, the boy managed to get possession of a small spinet in which the strings were bound with strips of cloth to deaden the sound, and, having it concealed in a garret, he taught himself to play without being discovered. When he was seven years old his father set out on a journey to visit a notable person who kept a private chapel with an organ and Handel begged to be allowed to accompany him; but, his request being refused, so strong was his persistency of

purpose that he followed the carriage on foot for a considerable distance, until he got his way, and finally managed to get permission to use the organ.

Benvenuto Cellini was destined by his father to be a musician and strenuous efforts were made to cultivate this talent from his early years when he was taught to sing and play the flute. "And though I was of very tender years when little children are wont to be pleased with a whistle and suchlike playthings, I had a particular dislike to it." All through his childhood he had a strong passion for drawing and nothing would induce him, despite his father's strong desire, to adopt the career of a musician. At the age of fifteen he apprenticed himself, against his father's wish, to a goldsmith craftsman so that "I might be free to draw as much as ever I liked. . . My desire to excel in this art was great, or rather, I might say, my love for it; but, indeed, both were strong in me." [4] It is not surprising after this to learn that in a few months he became noted for his workmanship and design, and thenceforward his genius carried him to distinction in his chosen art.

The direction of all inborn impulses is indeterminate, and it would be interesting to know in the two instances just given how they acquired their specific character; unless we are content to attribute them to heredity. Moreover, the purpose is, at the outset, quite unknown to the subject himself, who experiences a vague restlessness, as we see, for example, at the onset of puberty. When they have a definite tendency which is clearly known to the subject himself, this is always the result of experience. In so far as the urgency of an impulse is consciously experienced it is called a conation. There are, however, great differences to be found in the consciousness of the direction of the impulse.

The view here indicated, that native impulses or propensities to activity are all blind or indeterminate, and that new

propensities may be acquired, is in opposition to current theories of human nature. The problem we are about to consider is the most important in the whole field of psychology, being concerned with the forces that determine conduct. It is widely held, and supported by eminent authority, that the springs of human conduct are all inborn, and that the energy necessary for carrying out any act, habitual or otherwise, is all derived from pre-existing impulses. Thus Professor McDougall has strongly maintained that no habit can ever yield any impulsive energy or be a motive for conduct.[5] He denies that any motor habit, such as repeating the alphabet, which he strangely regards as his ' most practised habit,' or playing the piano, can in any circumstances become an impulse; and asks: "Does any such habit, no matter how perfected and how much repeated, become in itself a drive? . . . Does it generate, or is it sustained by, an appetite? Is it *in itself* a source of purposive activity? To all these questions the answer is clearly—No." He contrasts these cases with the impulse to strike an angry blow when hurt or insulted. Now it may be admitted at once that the occasions on which one is impelled to repeat the alphabet are rare, except perhaps to replace the blow by those persons whose careful bringing-up has taught them to count numbers or repeat the alphabet instead of giving way to anger. The efficacy of this method of response has been attested since classical times, for Athenodorus, the tutor of Augustus, bid him repeat the letters of the alphabet before acting on an angry impulse. Seeing that such reactions as this are commonly acquired as a response to situations which normally call forth the angry impulse, it is odd to refuse to call the alphabet reaction an acquired impulse. Anyhow, the reaction *is* sometimes effective as a substitute for the native impulse of anger, and it would seem that such a powerful spring of conduct could only be checked by something which

has itself the energy of an impulse. Religion, for example, as history abundantly shews, can mould human nature in opposition to the most powerful of native impulses, and a whole nation may acquire new characteristics by this means. And even a mistaken ideal, firmly held, is capable of moving individuals or nations to action, even to their own detriment.

He who doubts whether an impulse can be acquired need only consult those students who work at definite hours and in habitual ways, and he will soon find out that they experience a curious restlessness if anything interferes with their normal routine; and only rarely do they feel any desire to work at other periods. Or, take the case of the hardened swimmers who have acquired the habit of indulging in an early morning plunge, the strength of whose impulse may be gauged by the intense discomfort they are willing to endure to get it. That only their acquired habit can satisfy the acquired impulse is shewn by the fact that they do not derive satisfaction from a mere cold bath, however chill and uninviting. As to the query whether any habit can give rise to, or be sustained by, an appetite, the answer surely is in the affirmative. Everybody who has indulged the habit of smoking over a long period feels a strong craving which cannot be allayed in any other way; and the appetite is so specific that if he has cultivated the pipe habit neither cigarettes nor even strong cigars will satisfy the longing. The impulse is so accurately adjusted to the habit, from which it is derived, that one who is accustomed to smoke at definite hours, say after dinner, experiences the 'drive' only at those periods.

The fact of the matter is that our daily lives are ruled by acquired desires whose intensity is rarely realised unless their expectations are baulked. We go on unconscious of our propensities until something happens to check them. The average man has acquired such an appetite for his daily newspaper that he is intensely annoyed if deprived of it, and

irritated at any change in its make-up. Before broadcasting was invented few people wanted the day's news at night, but now whole sections of the population have a strong desire for it. Less than a century ago ale was the universal breakfast drink of English people. Who could now start the day without tea or coffee? The mythical young officer, on leave from the trenches, who shuddered at the thought of sleeping between sheets in a clean bed illustrates the same tendency. In short, all acquired propensities get their 'drive' not from some pre-existing fund of energy but from the overbearing force of custom. What gives the contrary view a certain plausibility is the failure to distinguish impulses, whose ends are clearly felt by the subject, i.e. conative impulses, from those whose purpose is not a matter of conscious experience. But all our primitive impulses are, at the outset, unconscious in the sense that their ends are not foreseen by us, and that we only come to know what we want by wanting it. This phenomenon is, in fact, not peculiar to our innate impulses but pervades our whole mental life. In the preface to a widely read sociological work the author[6] says: "Now that the book is finished, I can see, more clearly than I could while I was writing it, what it is about." The Freudians maintain that our desires start by being fully conscious and then become suppressed; but it is equally plausible to hold that they were all more or less unconscious, in the above sense, from the beginning and only became conscious in the process of being satisfied. "Desire for flowers comes after actual enjoyment of flowers. But it comes before the work that makes the desert blossom."[7] So that the problem for educational psychology is not to discover the mechanisms by which our desires and wishes become submerged, but the course of education by which we come to realise their meaning, and the methods most suitable for directing them into the proper channels. The education of the will by forming stable habits

of action in new directions is a creative act in that it implants in the individual life new sources of energetic impulse.

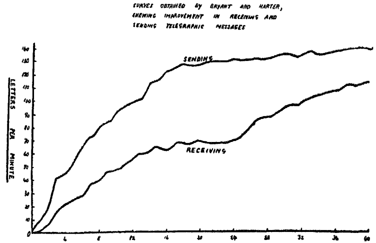
THE FORM OF PROGRESS

In the practical study of the formation of habits the rate of growth and decay of habitual activities are investigated and recorded as curves of progress or evanescence. The records may represent the time required for a set performance; or the amount of performance, such as the number of letters recorded correctly in a stated period; or the number of errors made in performing a definite amount of work. Such graphic records are called time, attainment and error curves respectively. Other forms of curve have been plotted, such as the attainment in certain units which can be reached without error, or with a given number of attempts, and so on.

Most habit curves display features which are worthy of careful study; they fall in the case of time or error curves, or rise in attainment curves very rapidly at the initial stages of practice, and at later periods they may become flat, exhibiting what are called 'plateaus' from which there may be a subsequent *sudden* rise or fall. The plateau is well shewn in the accompanying diagram. The rapid rise or fall in the initial stages is usually explained as shewing very great relative progress in the early stages of practice.

It should be remembered that every habit is composed, not of a single series of movements, but of several such series; forming a sort of hierarchy in order of difficulty, or comprehensiveness, or both. Just as, in recording a naval battle, the official reports of the individual captains reduce the observations of a number of individuals into one story, and the despatches of admirals are an attempt to telescope the reports of individual captains, whilst the Admiralty report

attempts to reduce them all to a single focus. Some of the lower orders of movements in the hierarchy consist of series of actions, the working plan of which is either instinctive or habitual and which therefore require little or no practice, consequently there is apparently great initial progress. No doubt also the zest of work is greater in the initial stages which may help to explain the rapid improvement. The higher or co-ordinating series of movements in the hierarchy are relatively novel and must be slowly built up. It is only



WEEKS OF PRACTICE

Curves of a single subject Note the plateau in the *receiving* curve

when all the lower series have been made automatic, and fused together, as it were, that the higher order habits can function easily on the basis of the lower Thus, to write or speak fluently in a foreign tongue, for example, it is essential to make the vocabulary and grammatical forms mechanically perfect before the higher language habits connected with the combination of words into connected discourse can display themselves freely. There is consequently a plateau period, followed by a sudden further improvement which resembles the rapid pro-

gress in the initial stages. The receiving and sending curves of Messrs Bryan and Harter may be taken as typical of the growth, i.e. of the varying rates of progress in learning a task such as a language. Careful study of these figures shews that the progress in the earlier stages is represented by an S-shaped curve, and this has been observed in many other cases. It should be noticed that the curves would present the same general form if the units of time had been hours or days, etc. instead of weeks.[8] It has been suggested by Professor J. Peterson [9] that some of the peculiarities of habit curves are due to the method of plotting the results and not to variations in the rate of learning. The initial rapid rise or fall in the curves may be partly explained by this cause. For it is clear that the units are not strictly constant, an error for instance being different at different parts of the scale; nor are equal practice intervals, or the performance of the same objective work, homogeneous units during the whole period. Plateaus, also, may be magnified or obscured owing to the same causes.

Numerous experiments have been carried out on the rate of verbal learning, for which Professor Ebbinghaus devised nonsense-syllable material [10] in order to eliminate meaning as far as possible. Such researches are usually called investigations into memory, but in reality they are mainly concerned with the formation of vocal habits. Evidence in support of this view is supplied by investigations on snails, which react to a diminution of light or to a shadow by withdrawing into their shells. Professor H. Piéron shewed that these gasteropods cease to withdraw after a certain number of obscurations; then, after a period of rest, they react again to shadows, but cease after a smaller number of stimuli, and so on after repeated trials. The animals, in fact, form a habit of movement: and the law which best summarises the rate of the decline of the inhibitory effect is the same

as the law of forgetting nonsense-syllables after varying intervals.

Just as there is an optimum interval for giving small impacts to a heavy pendulum in order to get a long regular swing so it has been shewn that there is an optimum interval between the separate repeated acts necessary to form a habit. This interval is a measure of the period required for maturing or fixing the impression, and is different for different acts. The succeeding impression in order to be maximally effective should come at the end of the optimum interval, otherwise work is lost. After this interval there is a period of evanescence. It has been suggested that such gradual maturing of impressions may be one of the factors producing the plateau.

All kinds of skill tend to decline if not kept up by practice, and experimental work has been done to investigate the rate of evanescence Ebbinghaus [11] was the pioneer in this field of investigation. His method was to find out the average time required to learn by heart a definite number of nonsense-syllables, after which he allowed varying intervals to elapse, and re-learnt them, taking note of the time saved on the second occasion, and thereby finding the amount he had retained and forgotten in each interval He found that one hour after the original learning one-half was remembered, after eight hours one-third, after six days one quarter, and one-fifth was retained after a month. Thenceforward the rate of decay was very slow indeed

In an investigation by the present author, for a different type of learning, a diagram composed of ten straight lines, intersecting at random, was exposed for five seconds at a time After each exposure an attempt at reproduction was made The number of exposures for correct reproduction was recorded After half an hour's interval the number of exposures required for relearning shewed that one-eighth was forgotten, and after a lapse of fifty days one-third was lost.

Swift found that after forty-eight hours' practice on a typewriter followed by a two-years' interval, only ten hours' practice was required to recover the same speed.

It is evident that the rate of decay is rapid at first, and then slows down with lapse of time until it becomes negligible. This is for learning by adults. For children there is slight evidence to shew that the rate of evanescence is slight at first but more rapid later on. The numerical results of his experiments led Ebbinghaus to formulate the law that the ratio of the amount retained to the amount forgotten is *inversely proportional to the logarithm of the time, calculated in minutes from the end of the learning period.*

THE IMPORTANCE OF PURPOSE

Habits are formed by repeated purposive acts, which create new bodily functions, facilitating future action of a similar kind. Psychologically, then, function determines structure; the conative impulse creates the instrument by means of which it may issue in action. Much psychological theory, as we saw earlier, is vitiated by the adoption of the physiological standpoint which inverts this relation between function and structure. As the organ becomes increasingly more perfect it becomes more automatic, and the conscious direction of the movements tends to become subconscious. When creating a new habit it is possible, by careful introspection, to watch the gradual disappearance of effort and attention as one increases in facility. In deeply ingrained habits, such as writing, the strokes of the pen are made quasi-mechanically; there is the intention to write but no specific purpose to make the pen strokes, which go on almost of themselves. Owing to this feature of perfectly acquired habits it is erroneously inferred that the bare mechanical repetition of an action

is sufficient to form a habit. But this is to confuse the end-product with the means necessary to bring about its formation. Now the stimuli which set a habit going are not exactly the same on any two occasions. Vital activity is distinguished from purely mechanical response by the power to adapt itself to considerable change of circumstances. Beneath the apparent stereotypy of habit there is always some variation which the subject, when acting, usually ignores because he has other and, it may be, more important purposes in hand. Yet it has been well said that, if a habit is to have "sufficient generality to adapt itself to variations in its external stimuli, it must be combined with and supported by some organised body of ideas." [12]

The rôle of purpose in habit-formation has been subjected to experimental research, and it has been shewn that mere repetition without consciously directed effort is almost useless to establish a habit.

Messrs Bryan and Harter found, in the case of telegraph operators who were learning to send messages, that the rise from the plateau in the attainment curve only took place when there was a deliberate attempt to improve on the part of the person owing to some strong incentive, such as the desire to secure extra pay. It is the intense effort which results in effective learning Similar results have been obtained by Miss M. Smith and Professor McDougall in learning to reproduce series of nonsense-syllables They shewed that the greater the passivity of the subject the more numerous were the repetitions required to learn a series by heart. In other words, when reliance is placed on mechanical repetition, learning is slower and more difficult. Thus, on one occasion 13 and 9 repetitions were sufficient for these subjects, on the average, to learn a series of twelve nonsense-syllables when they each made a maximum effort. When, however, they adopted a passive attitude an average of 89 repetitions was

necessary for one subject and 100 for the other. It may be thought that the vastly increased number of repetitions would secure better retention of the material learnt. But this was shewn to be fallacious For on attempting, after an interval of some days, to relearn certain sets of series, which had been originally learnt either actively or passively it was found that a greater number of repetitions were required in the latter case. In fact most of what had been learnt passively was forgotten after about one week.[13] The will to learn plays a real part in habit formation.

Habit is, thus, not mere mechanisation, but demands the co-operation of set purpose, at the very least, the purpose to learn. For as Professor Dewey [14] says: " How delicate, prompt, sure and varied are the movements of a violin player or an engraver. How unerringly they phrase every shade of emotion and every turn of idea. Mechanism is indispensable. If each act has to be consciously searched for at the moment and intentionally performed execution is painful and the product is clumsy and halting." The difference between the artist and the mere technician lies in the fact that the latter is the slave of mechanism; it is mere routine. So, in intellectual matters, progress and skill rest on the formation of habits of thought, but whilst intelligence needs such habits, which are the condition of its guidance along definite channels of expression, the rôle of the artist is always an integral part of the performance.

If we take a wide survey of human conduct it is evident that many of our important habitual actions owe their origin to the copying of the same activities in others. Everybody is influenced in his modes of thinking, feeling, and willing by the particular social milieu in which his life is passed. As our habits are acquired in a social atmosphere the problem of imitation is an essential part of the study of habit-formation, as may be seen from the fact that our fundamental habitual

acts, such as speaking or writing, could never arise without the aid of models to imitate, despite the fact that both are ultimately based on the native impulse to communicate with our fellows. The rapid spread of a new fashion or a new game may serve to illustrate how potent is the influence of imitation in forming habits of conduct. As fashions usually spread from the ranks of people occupying a higher position in the social scale, we may surmise that a certain degree of prestige is necessary in order that a habit of action may diffuse throughout a community. This view is confirmed by the historical observation that, with the spread of Roman conquest, Roman civilisation was adopted by the subject peoples But although the Greeks were subdued they did not imitate the Romans but rather were imitated by them, so great was the prestige of Greek culture and civilisation. We see the same cause in operation daily; for when a new idea or theory comes with the prestige of a great name or a great institution it is immediately adopted, whether intelligible or not, by the generality of mankind. It is difficult to say in what prestige consists, but anything which is or is thought to be authoritative has some of this quality, and a newspaper with a large circulation may use such authority to change not only the habits of political thought of its readers, but also their modes of living and the very food they eat.

Imitation is often described as being either imitation of the movements required to bring about certain ends or imitation of the ends themselves. But it is hard to find unimpeachable natural examples of the former kind of imitation. The closest approximations to the imitation of movements are seen in drill, the object of which is to secure as uniform a habit as possible. Being entirely artificial in nature drill has no educational significance. Anyone who contrasts the rigidity and uniformity of a drilled troop with the flexibility and variety of a performance, say, in eurhythmics

will easily realise that imitation of movements is at once artificial and sterile The soulless imitation characteristic of an earlier generation in teaching the rudiments of learning to young children, whereby they were forced to uniform repetition until they fitted the Procrustean pedagogical bed, is a warning against artificial imitation of movements, and is happily almost completely given up. It is here that the configuration theory of the mind comes to our assistance. For learning by imitation is not the piecing together of isolated part activities, but the reproduction of a figured whole. Improvement depends on a better insight into the relations of the configuration. If I look at my watch because another person has pulled his out, what I imitate is 'seeing the time,' for my watch may be in a different pocket from my neighbour's, or on my wrist. I am not interested in his movements, but simply in the configurative whole which is presented by his actions. In fact, what is copied in learning by imitation is the *purpose*, which is attained by a repetition, as it were, of the underlying melody-figure, just as one may imitate on a violin a melody which has been played on a piano.

IMPROVEMENT IN RETENTIVENESS

It is a matter of common observation, repeatedly confirmed by experiment, that individuals improve by practice in the facility of accomplishing habitual tasks. Thus a person, who sets out to learn a number of series of nonsense-syllables of the same length by heart, finds that he can within limits learn each series with a less number of repetitions as time goes on. Moreover, the number of repetitions required to relearn a series after an interval also diminishes with practice. The question arises as to whether the improvement

shewn in relearning such series is due to an increased power of retention or whether it is due to greater facility in learning. Some interesting experiments have been carried out by Miss M. Smith and Professor McDougall to decide this point [13]

Five subjects had almost daily practice for six months and one subject for twelve months in learning series of syllables, on one day a series was learnt and a day later it was relearnt and so on Now it is clear that any improvement due to better methods of learning will operate equally in the relearning process. Consequently, if evidence of increased retentiveness is desired, it must be looked for in a greater relative improvement in the relearning process as compared with that of learning. The table below gives the results obtained :

Subjects	*Average of 8 expts giving no of repetitions for learning at beginning*	*Average of 8 expts giving no of repetitions for learning 6 months after*	*Gain*	*Average no. of repetitions to relearn at beginning*	*Average no of repetitions to relearn 6 months after*	*Gain*
A	14	8	43%	7	4	43%
B	16	9·6	40	5 6	3	47
C	8	7	—	3	3	—
D	9	5 6	38	2 8	1·2	57
E	13	11	15	9	6	$33\frac{1}{3}$
*F**	12	8	$33\frac{1}{3}$	6	4	$33\frac{1}{3}$

* Interval of 12 months

It will be seen that B, D and E shew a greater relative improvement in relearning. For these subjects, therefore, it seems as though the practice has resulted in increased power of retentiveness. The other subjects either shew no improvement or equal improvement in both processes. It would be hazardous to base any conclusions on these experiments until they are confirmed by more extensive investigations. The method is sound and the topic is well worth more extended research, for owing very largely to the influence of William James [15] there is a widespread belief that a person's native retentiveness is a physiological property of his nervous

system, which he can no more change than he can, by taking thought, add a cubit to his stature.

THE NEURAL BASIS OF HABIT

The classical accounts of habit-formation regard it as completely a physiological affair, a series of reflex-arcs somehow established in the nervous system. A reflex system in its simplest form is composed of a chain of anatomically distinct nerve units or neurones, functionally connected in a sensorimotor arc. Consider, for example, the movements of fixation-accommodation of the eye, i.e. the automatic movements made by the eye, when stimulated by light, which serve to bring it into such a position that the image of the fixated object falls on the retina in the place of clearest vision, namely the *fovea centralis*. This involves two relatively distinct sets of movements, namely movements of the eyeball secured by contraction of the muscles attached to the eye bringing the *fovea* into the correct position, and variations in the degree of curvature of the lens to ensure proper focusing as a result of the contraction of the ciliary muscle. For the sake of simplicity let us confine our attention to the eyeball movements alone, though it must be remembered that these are complicated by movements of the head also, and, it may be, of the whole trunk.

Now the reflex-arc is usually described as composed of three distinct parts; an afferent portion, the receptor or so-called sensory part which receives the stimulus; an efferent portion, the effector or motor part which brings about the movement; and finally a central portion which serves to connect up the anatomically distinct sensory organ with the motor organ. Corresponding to these parts there are afferent, central and efferent neurones, and in the simplest ideal case

a chain of three neurones would suffice When the sensory neurone is stimulated, say, by light falling on the periphery of the retina, energy already stored up in the nerve is released, which in its turn fires off the stored energy in the central neurone, and this liberates the energy in the motor neurone leading to a muscular contraction which brings the *fovea* to bear on the luminous object, thus completing the sensori-motor arc Nothing could well be simpler or more beautifully arranged for a mechanical explanation, as in the case we are considering the 'pathway' of discharge is already laid down in the nervous system, though it is said to be made smoother by maturation and experience.

In accordance with this view it is maintained that the most complex habits can be explained as a combination of such reflexes,[16] being "nothing but concatenated discharges in the nerve-centres, due to the presence there of systems of reflex paths, so organised as to wake each other up successively—the impression produced by one muscular contraction serving as a stimulus to provoke the next, until a final impression inhibits the process and closes the chain" The only difficulty in this explanation, according to its author, is to account for the original formation of the 'pathway,' since when a wave of energy has once traversed a sensori-motor arc nothing is easier than to imagine that it should travel along it more readily the second time

In considering this explanation the student must be warned carefully to discriminate between the facts of observation and theoretical deductions therefrom. Otherwise, he may be inclined to suppose that physiologists have discovered central connections between sensory and motor processes which the psychologist is at liberty to use, whereas the direct contrary is the case, and the nervous connections are merely hypothetical connections prayed in aid by psychologists in order to explain the observed facts. The fact to be explained

is the apparent mechanisation of habit by repetition and the fixed nervous pathways are pure theory.

Let us, however, test the theory by trying to apply it to our original example of a reflex act. The actual movement of the eye in order to fixate a definite point in space depends not only on the particular part of the retina stimulated, for which it is possible that a definite, though an uncomfortably large, number of central connections are provided, but also on the original position of the eye with respect to its orbit and likewise on the initial position of the head. All this presupposes that each retinal point must be connected with an indefinitely large number of central neurones. But the microscopic size of nerve cells and their numerous dendrites provide the psychologist, who hankers after a neural basis of explanation, with such enormous numbers of possible central pathways that he need not be disturbed by mere magnitude.

Experimental observation introduces a new difficulty in the way of the theory. Marina, experimenting on apes, performed an operation on the eye and interchanged the superior rectus muscle for the lateral rectus, i.e. the muscle moving the eye outwards was eliminated and its place taken by the muscle which normally lifts the eye upwards. After the wound was healed, the animal ought to have made the most surprisingly awkward eye-movements in the endeavour to fixate points in the field of vision, and to save the theory of neurone connections from disaster. Instead of which, when he got over it, he calmly carried out both voluntary and automatic lateral movements properly; and Marina concluded that "the anatomical association-pathways from the centres to the muscles are not fixed." If, then, we cannot rely on the fixed pathways in the nervous system to account for reflexes, the theory of the neural basis of habit which rests on it becomes very shaky indeed.

These, and the like difficulties, which are usually glossed

over or ignored by physiologists and psychologists alike, not only make it difficult to believe that habits are due to a concatenation of reflexes, but also lead to doubt as to the existence of fixed nervous connections between the sensory and motor sides of habitual actions. Habits do indeed tend to become quasi-mechanical with repetition, but it is too readily assumed that this implies that they become stereotyped; whereas we saw earlier in the chapter that such a view is untenable. Take, as an instance, the act of signing one's name, which is about as mechanical a habit as a man can acquire. Sometimes the paper is to the right, sometimes to the left, sometimes forward and again near, on occasions level with the edge of the desk and on others tilted at an angle; and in every position a more or less different set of movements is necessary. Again, one may write with a pen on paper or with chalk on a blackboard, and in the latter case a very different group of muscles is employed, for instead of moving the fingers and the wrist the whole arm is involved. Yet every time the same form of signature is produced. What, then, becomes of the fixed chain of central neurones; or are there several chains each appropriate to a different set of circumstances? The difficulty is accentuated when it is remembered that if I write simultaneously and unreflectingly with both hands the left hand produces a mirror image of the right hand movements. Are we to suppose that the establishment of the right hand set of neurone paths led originally to the formation of an equivalent series for the left hand? Anyone, who is still sceptical, may easily convince himself by the experiment of sitting on a chair with one leg pointed straight forward, and he will be able with little difficulty to trace his usual form of signature in the air with his big toe. As he has, presumably, never done this before, there can be no pathway in the nervous system to account for the movements.

It is much more in consonance with the actual facts to turn aside from the fixed pathways and to describe the matter in psychological terms only. We say then, and all the facts of observation support the description, that what a person is trying to do on each occasion, when he signs his name, is to adapt his movements to a somewhat similar sensory configuration or pattern. The partial movements constituting the act of writing are reflexes; but, even so, the whole act is something other than the sum of these movements, just as a melody is a different thing from the mere collection of notes contained in it. And as a melody can be played in different keys so, we have seen, can a habitual act be reproduced in a variety of forms. The musical analogy has been deliberately chosen, since it gives a truer conception of the growth of habit than the hypothesis of tracts or pathways in the nervous system uniting the sensory and motor sides of the process.

At one time it was the fashion, owing to the prevalence of the association theory, to explain all mental growth in terms of bonds of association between isolated mental data, and the theory of habit which we are challenging is nothing but the doctrine of associationism applied to bodily movements. Instead of starting with a chaos of disconnected movements, sensations, ideas or other 'mental atoms,' subsequently reduced to order by the magical virtue of association, we believe that a certain arrangement dominates conscious life from the very beginning. If movements were originally independent of the sensory or ideational processes it is difficult to explain how they ever became associated together. The doctrine of associationism is no more intelligible when the assumed elements are reflexes than when they are 'ideas'; it simply will not work. From the very outset a child's experiences are comparable to the discrimination of notes within a chord, the rest of the chord consisting as yet of an undifferentiated volume of sound to be subsequently analysed.

The chord is the primary experience, and it is the psychologist's task to explain how the separate tones come into experience, if indeed they ever do so. The fatal blunder of mental atomism or associationism was to start from the most developed experience, the separate tones, and as might be expected it failed completely to shew how the experience of a chord could ever be derived from the sensations of separate notes. The configuration theory rightly insists that form, order and arrangement dominate mental life from first to last. There is no such thing as a 'mental factor' isolated from others, but all mental life is figured or has a structure or pattern *ab initio*. We do not require any theory to account for the configurations since they are our data, but rather we should call for an explanation of isolated factors if they were ever found. So, it is reasonable to demand an explanation of the psycho-analytic 'complexes' since these are said to be cut off from the rest of conscious life. What, however, does need explanation, and this is never given by any physiological account, is how these patterns become organised.

To revert to our previous analogy, a musical person hears a tune differently from an unmusical, but neither of them hears separate tones, they both listen to melodies. The musical person has however a greater insight into the structure or configuration of the melodies. Just as intellectual growth may be considered as consisting of greater insight into the harmonies which the world offers for our appreciation, so habit-formation is the reproduction in terms of movements of the configurations presented to the senses. In forming a habit the person is persistently trying to translate the meaning of sensory impressions into motor language. Why, then, it may be asked is repetition necessary to form a habit, unless we are blazing a trail through a forest of neurones in order to establish a permanent pathway? The answer to this question

has already been given, for we saw that mere repetition of movements is useless. The attempt to learn a series of nonsense-syllables by passive repetition is wellnigh hopeless It is only successful, if at all, because it is impossible to keep the mind perfectly passive. If success is attained the series is rapidly and completely forgotten, for as we stated above, there is little difference between the number of repetitions required for relearning what has once been learnt passively and the number of repetitions required to learn for the first time. When, on the other hand, such a series is learnt with determination it is never completely forgotten. On the assumption of the linking up of a chain of neurones such a difference is inexplicable, for as far as the nervous connections and muscular movements are concerned it is immaterial whether we repeat the series with or without the desire to learn. The function of repetition in habit-formation is, therefore, not to establish paths of low resistance but to attune the muscular system to the appropriate configuration, just as a violin only yields the best tone after prolonged use by a master-musician.

To form a habit is, in short, to compose a movement-melody, and the act of composition cannot be carried out passively, since the structure or form of the melody must be kept steadily in view. The situation pipes a relational tune and the person dances in the appropriate rhythm. It is necessary to repeat the actions again and again in order to reconstruct the proper rhythm. As soon as the suitable configuration has been realised, but not before, further repetition makes the behaviour steadier and more facile. This is doubtless part of the explanation for the sudden rise from the plateau in habit curves as the result of practice; for as long as the configuration remains unclear, progress is very gradual, but once it is clearly discerned improvement is made with a bound. A steady continued purpose to understand and act on the situation is an essential feature in habit-forma-

tion. Mere repetition without such insight into the pattern of the situation will never produce increased facility. Thus we see that the motor neurones respond to the sensory because together they form a unitary physiological organ, in which the parts function in harmony. It should not be difficult in these days of 'wireless' instruments to conceive how a transmitter and a receiver can function together without a fixed pathway of connection. All that is necessary is that the one should be attuned to the other. Future research must discover the physiological mechanism on which such attuning in the animal body depends before a satisfactory theory of the neural basis of habit can be formulated.[17] It has been necessary to go at such length into this matter owing to the persistent attempts to give physiological explanations of mental events; and if they are unjustified in the sphere of habit it is hard to see where else they can be successfully used.

HABIT AND INSTINCT

We have made no reference, so far, to those activities which have sometimes been called racial habits, or instincts Just as the established customs of communities serve to explain why all the individuals behave in the same way, so the instincts of animals or men are supposed to explain why different species behave in specific ways. The relation of habit to instinct, which we now proceed to consider, is but another aspect of the problem of mental heredity which has been dealt with in an earlier chapter. Locke had compared the human mind to a blank tablet or *tabula rasa*, on which experience wrote any characters that were subsequently found there. The mind had simply certain general capacities, such as memory, just as a blank sheet has the property of retaining marks made upon it And just as a sheet of paper has

no preference for any particular writing so the mind had no inclination or propensity in any specific direction.

Leibniz,[18] a contemporary of Locke, had protested against this view, maintaining, on philosophical grounds, that there must be certain innate predispositions in the human mind to account for human knowledge. He compared the mind to a block of marble which was not homogeneous but had certain veins in it. From a homogeneous block a sculptor could carve any figure indifferently, but from a veined block one particular form in preference to others would be easier to obtain, as Michel Angelo had to give an awkward drop to the shoulder of his David, owing to the elongated shape of the block from which he chiselled it. In this sense Leibniz held that one particular figure in preference to others was innate in the marble, though, of course, it is still necessary for the genius of the artist to produce the figure by working in the way predetermined by the structure of the marble. "It is in this way that ideas and truths are innate in us, like natural inclinations and dispositions, natural habits or potentialities"

As psychologists we are not concerned with innate truths and ideas, but with the question whether there is anything inherited which can be described as an inclination, propensity, disposition or drive. Or, to use the phraseology of an earlier chapter, has the mental tissue any inborn woven patterns? The publication of Professor McDougall's *Social Psychology* inaugurated a new era in the discussion of this topic, as he gave a precise scientific meaning to the notion of instinct, which had previously been vague and inchoate; and described the instincts of man. He enumerated, at a later time, thirteen major instincts in addition to a number of minor ones, which were comprised in the inborn constitution of the human species. Many other such lists have been drawn up, but none with such insight into human nature.

The list includes the parental instinct, the sexual instinct, the combative, the acquisitive, the instinct of curiosity and so forth; all outstanding inborn characteristics of human beings, by virtue of which they are all impelled to act alike. Now actions like the building of nests by birds, and most of the activities of insects, are remarkably alike, though they shew adaptation to varying conditions Such activities, owing to their great similarity among the individuals of a species, and to the fact that they are advantageous though untaught, may be described as instinctive. There is a world of difference, however, between the use of such a descriptive term as instinctive calling attention to certain features of action, and the explanation of conduct by means of a set of forces called instincts which impel a man to action.

I have examined this notion of inborn propelling instincts as applied to human conduct in *The Mind and its Body*[19] There it is shewn, more especially with regard to the most powerful of them, namely the so called sexual and the parental instincts, that their particular forms in human conduct are the result of the action of the social environment. Their power over us is due to the impulsive power of habit and the momentum of custom, which by giving a certain rigidity to the social environment ensures uniformity of conduct.

The conception of instinct has always presupposed an inherited organization of the nervous apparatus, and an equally inherited muscular and glandular organisation to cope with certain definite situations in the environment. This idea, derived as was said above, from the study of instinctive activities in the lower animals has been extended to explain human conduct. Except that, in the case of man, an inherited mental constitution, common to all men, has been added to the bodily mechanisms For the most recent treatment of the subject, in the fascinating book *The Energies of Men*,[20] we are again indebted to Professor McDougall who

emphasises " another distinct unit of organisation," namely the inherited ' drive ' or propensity, which is the name given to that part of the innate constitution whose nature and function it is to generate, upon occasion, an active tendency to conduct. The criterion of instinctive action is, therefore, the existence of innate propensities geared to inborn abilities. The lower we descend in the scale of life the more restricted is each propensity to its corresponding ability, but as we ascend the scale each propensity becomes allied with a number of different abilities, each of which may be used in the service of several propensities. Believing that the enumeration of man's native abilities is a task beyond our comprehension he thinks that it is possible to give an approximate estimate of the native propensities, and that for the study of human society it is essential to do so. Since " there is no room for doubt that such inborn propensities are the very foundation of our mental life, that they provide the driving forces, the hormic energies manifested in all our activities from the simplest to the most complex." In addition to certain simple propensities or drives serving bodily needs, seventeen major propensities are given, such as food-seeking, the sex-propensity, the parental, the gregarious, the acquisitive and so on.

The reader will remember that in the chapter on '*Mental Heredity*' evidence was produced to shew that even the food-seeking propensity acquired its definite character by virtue of experience Apart from the effects of habit this propensity was shewn to be blind and indeterminate. Habitual action not only gives definiteness to the drive but, by arousing expectations, generates the appetite. All inborn propensities are, in fact, mere latent possibilities which only become actualities as the result of suitable exercise in an appropriate environment. As we have so often insisted, heredity and environment are mutually involved, and to consider one without the other is to deal with abstractions, not realities.

In order to make our ideas more definite it will be better to inquire into one of the most powerful of the propensities, namely the parental, and we may reasonably assume that what is true of such a strong motive to action applies, *mutatis mutandis*, to all of them, in fact with much more force We shall confine ourselves to the maternal 'drive,' as this is obviously much more powerful than the paternal. Moreover, it is extremely doubtful whether any psychologist, who restricted his observation to fatherly behaviour alone, would ever have arrived at the notion of a parental instinct in human beings, for fathers so obviously get to love their children by protecting them and playing with them, and this affection increases with the amount of care they bestow on them. Again, nobody has suggested that there is a filial instinct, whilst few would deny that filial piety is a response to parental behaviour, though the psychoanalysts attempt to derive it from the sexual propensity. General observations, however, breed no conviction in the scientific mind We are indebted to the experimental biologists for an examination of maternal behaviour in the lower animals to which we now turn.

To talk of a propensity to certain types of behaviour is to over-simplify very complicated situations. It is a mistake to assume that, because we employ one word to describe maternal behaviour, there must needs be one propensity or 'drive' underlying all its manifestations Even if we take the simpler cases of this 'drive' in the lower animals it is far from simple For maternal behaviour, like all other behaviour, comprises several activities which may be largely independent of each other Thus in rats, which have been studied from this point of view, we have the following among many other components of maternal behaviour, nest building, retrieving or bringing back the young to the nest, defence, licking, nursing. And not only do animals of the same species vary greatly in the different parts of this behaviour,

but some of the activities may be completely absent whilst others are well developed. This state of affairs has been summarised by two biologists [21] who recently made an intensive study of such behaviour "Previous authors have not hesitated to use the expression 'maternal drive,' referring, of course, to the underlying cause of maternal behaviour. It seems, however, that several drives must be invoked in an analysis—retrieving drive, nest building drive, and so on —however strong the objections may seem. For it is certain that a 'one-factor hypothesis' cannot account for the observations. It might be argued that the combination of *all* or most maternal activities (which is the rule) is caused by a 'strong maternal drive,' whilst the reduction of maternal behaviour to either retrieving or nest building is caused by a 'weak maternal drive.' But obviously such an assumption could not account for the separate occurrence of either of these two activities. . . . It is not sufficient to investigate the manifestations of one particular activity and then to generalise conclusions with respect to the whole complex of maternal behaviour."

What is not sufficient with regard to maternal behaviour is equally insufficient in the case of all other complex activities. To say that a certain mental aptitude is part of the original constitution of man does not carry us far unless we can analyse the various parts it contains Any inborn aptitude, as we have said before, is of the vaguest nature and its parts becomes specific only in the course of experience; whilst the motive force is derived entirely from the appetite which repeated activity of the same kind always yields. Our study of habit formation has shewn that such appetites for particular modes of activity can also be developed when there is no inborn basis; but when an inborn propensity exists the appetite is decidedly stronger and more permanent.

The conclusion we have reached as the result of the study

of lower animals is borne out by anthropology. In a study of various primitive races Lord Raglan,[22] who has a wide acquaintance with the lives of primitive folk asks the question, What is a father ? which is a bit more easy to ask than to answer. For in both ancient and modern times the idea of fatherhood involves essentially the idea of the ownership of children, but whether he is their begetter or not makes no difference either legally or sociologically "But why should a man wish to be a father ? Those who hope to solve these problems by gazing earnestly into the fire instead of studying the facts will no doubt answer, 'the paternal instinct,' but why can this instinct only be satisfied by a son, never by daughters, and why in so many civilized communities is a man who has no son considered to be in a parlous state ?" The answer appears to be because men desire immortality "A man wishes for a son to bury him and look after his grave ; to keep his memory green, to succeed to his name or his title, and so keep it alive ; to keep up the old place and the old family portraits." This opinion seems to me to shew a clearer view of the motives which influence human nature than those which attribute human conduct entirely to the operation of instincts or inborn propensities. Man is influenced much more by attracting forces, such as the desire to perpetuate his memory, than by the propelling forces due to his biological equipment.

Professor McDougall is too profound a student of human nature and institutions to be oblivious of this difficulty, though he still maintains that the life of man is rooted in instinct. He does not regard the sort of instinct found in the uniform activities of insects as typical of human action, but he thinks he can discern well-marked goals at which all human societies aim, and these he thinks demand that we should postulate appropriate inborn propensities. "I propose

to avoid the use of the term 'instinct' in defining the constitution of man, and to content myself with the term innate or native propensity. This change of usage does not imply any radical change of view. It implies a stricter usage of the words instinct and instinctive and a recognition of the questionable propriety of applying these words in the description of human nature and activities. I recognize that, in the fullest and most universally accepted sense of the word, instinctive action is peculiar to the lower animals" Undoubtedly this opinion is justified, but the uniformity of the goals men aim at can be adequately explained by the similarity of customs due to the diffusion of cultures. To account for the tenacity of custom it is not necessary to derive the motive power from the native endowment of the mind The impulsive power of similar habits, due to imitation in a social environment, is sufficient for that. In the light of all the evidence, therefore, I think that not only must we give up the belief in human instincts, but also in any rigid inborn propensities to action. If we still hold fast to native propensities the number of them necessary to explain conduct must be inconceivably great and not limited to a dozen or two, since, as we have seen, each propensity is a general name for a host of independent drives subsumed under it. And something like this view, as a matter of fact, has been put forward to explain Intelligence, which has been supposed to consist of an indefinitely large number of elemental drives. We shall turn to the consideration of this matter in the final chapter on '*Mental Tests*.'

CHAPTER VII

MEMORY

Meaning of Memory—Reminiscence—Effect of Distribution—Memory and Interest—Can Memory be Trained

THE MEANING OF MEMORY

DESPITE the large volume of experimental research devoted to the elucidation of the problem of memory very few generalisations of unimpeachable significance have been achieved. As with many other topics in psychology one difficulty arises from the loose use of terms. Experimentalists, following in the wake of theoretical writers on the subject, have equated memory with a universal function of organised living matter, namely *retentiveness*[1] In this wide use of the term a new-born baby who exhibits the grasping reflex by supporting his weight with his hands, since he is assumed to repeat an action which was once useful to his ancestors in climbing trees, is said to remember the act Nay, further, a daisy kept alive in a pot, in the dark, which closes its petals at dusk and reopens them at dawn is said to reproduce in memory its previous activities in the field If we believe, as Samuel Butler did, that all such physiological retention is ultimately the outward expression of some life purpose, and there is a good deal to be said in favour of such a view, it illuminates the situation to call the above cases expressions of habit. But only confusion ensues if they are denominated

by the name memory, as this leads to the belief that what is true of them applies equally to memory proper. We shall have occasion to see in the sequel that this belief is erroneous. The earlier psychologists defined memory as a revival of ideas, in so far as such revival consciously reproduced a previous experience without transforming it. But such a state of affairs is impossible, as the witness in a law court who is expected to reinstate the past, the whole past, and nothing but the past experience very soon realises Before explaining the reason for this, we ought to draw a distinction between habit and memory proper.

An illustration will make the situation clear. Suppose a boy is asked whether he remembers the binomial theorem, he will probably repeat the formula $(a + b)^n$, etc. And it may be that the whole thing is incomprehensible to him Assume, however, that he has recently followed the proof of the theorem for the first time and has been lucky enough to grasp it, and that he is now asked whether he remembers it. After some hesitation he may recall the various steps as he followed them, each suggesting the next and possibly the order in which they were presented, or he may have forgotten this and yet reproduce the logical sequence. Recalling the formula is psychologically very similar to the reproduction of a series of meaningless symbols, for schoolmasters know perfectly well to their cost that it is a mechanical habit ; whereas the recollection of the proof is a different phenomenon involving habit, no doubt, but being in the main an act of true memory.

Now every concrete act of memory contains these two relatively distinct processes mingled in various proportions. The habit process, which is the predominant one in all instances of learning by rote, was studied at some length in the preceding chapter. There we saw that in such learning the various repetitions were consolidated into a single quasi-mechanical

set of movements, and during recall the movements were repeated in the order in which they were learnt. True memory has different characteristics; it involves self-consciousness and the recall has a definite date, place and setting, i.e. its individuality is not merged, at first, into other similar activities. In course of time, with repetition, the personal aspect may fall into the background and we get almost impersonal memory, where the distinguishing marks of date and setting tend to disappear; as when the student at college reproduces the proof of the binomial theorem, having begun to forget when, where and how he learnt it

Professor Bergson, who first called attention to the distinction named the two processes, habit-memory and image-memory respectively.[2] The former, he acutely observes, is not so much a part of the subject's past as of his present and future activity, whilst the latter is re-presented in its setting, and unlike the former which must be reproduced piecemeal, it may be revived as a whole in a single act of intuition. But, as we said above, no useful purpose is served by calling the former memory, though it may be descriptively designated as 'habit enlightened by memory' or physiological memory. For Bergson's true-memory the name image-memory is objectionable as being too restricted, since it would exclude the possibility of imageless remembrance, or the memory of meanings without recognisable images. To distinguish it from the other we may conveniently call it psychological memory, though as previously indicated the two forms are never found apart in human experience It is a trite remark, but well worthy of emphasis, that there is no such thing as a memory; there are only persons remembering. Were it not that it would lead to intolerable circumlocutions, it would be as well in any discussion of the subject to write about persons instead of memories, when many difficulties, such as those concerned with memory training, would be avoided.

Interesting experimental verification of the distinction between habit and memory has been forthcoming,[3] and similar experiments ought to be repeated with other material. Various tests involving the capacity of retention were given to about forty persons and marks were assigned for correct performance Since both habit and memory involve retentiveness the tests were of two kinds, some requiring the reproduction of unique experiences in which habit could therefore play no part, others, such as the learning of nonsense-syllables, demanded the reproduction of movements learnt by repetition. The correlation coefficients of the marks for the former tests were ·61 and for the latter ·53, whilst the marks for tests taken from different groups shewed, on the contrary, no correlation. Success in one set of tests did not necessarily carry with it success in the other. An additional test consisted in reproducing the substance of a prose passage read to the subjects, which is typical of the kind of memory demanded in scholastic work. This test shewed affinities with those of both groups yielding an average correlation coefficient of ·24 with the members of the first group, and ·41 with the latter. It is evident that such a test comprises both processes, for several phrases are already well known and will be reproduced verbatim as verbal habits, but if the subject-matter of the passage is previously unknown, its reproduction calls for an effort of pure memory.

Experiments on the rate of evanescence also point in the same direction. When the material to be learnt consists of meaningless syllables it has been shewn that the popular view is correct, namely, that, other things being equal, what is learnt more slowly is also retained longer, and that quick acquisition means quick forgetting. In other words there is a negative correlation between quickness of acquiring a habit and its retention When we pass to such a task as the learning of German-English vocabularies, where there is more admixture

of psychological and physiological memory the relation begins to be reversed. A group of eighty students learnt such lists for a period of three weeks It appeared that those who learnt more than the average number of words in a given time were also above the average in retaining what had been learnt when tested after a month's interval, the rapid learners were also the better retainers. Further, in learning verse or prose where the psychological factor is still more prominent, there has been found a positive correlation between rapidity of learning and retention of what has been learnt.

Indirect evidence of the distinction we are insisting upon has also been furnished by experiments on the direction of associations.[4] It was found that for physiological memory the associations are quite irreversible, i e. they go forward only, as is seen for instance in the difficulty of repeating the alphabet or a series of nonsense-syllables backwards. It is as though there were a forward conducting system, so that the earlier the link in the chain the higher its potential with reference to later links For psychological memory the direction of the associations is completely reversible. The former is a directional function, the latter signless.

In the previous chapter we saw that the attempt to explain the uniformity of habit by a series of fixed central pathways in the nervous system presented almost insuperable difficulties The assumption that psychological memory is wholly explicable by brain physiology is subject to further criticism still In any case, all that is known by direct observation about memory proper can be adequately described without reference to a physiological substratum, as the rest of the chapter abundantly shews Memory implies mental functioning, and " if a given functional activity entirely ceases, it does not 'leave behind it' a structural plasticity that survives independently. On the contrary, when the function

has completely lapsed the molecular structure has no longer any 'power' to facilitate its recurrence. . . . The functional activity must surely be the formative principle. For to assign this priority to structure—meaning thereby molecular configuration—is to accept the materialists' *generatio æquivoca* of life and mind from inert 'stuff.'

"Again the attempt to get behind the psychical by talking about a physical arrangement of molecules *predisposing*, is to allow oneself to be misled by a metaphor, as if inert matter could ape the living mind. There is no predisposition in nitric chloride to explode if slightly disturbed . . . analogous to an irascible man's outburst when slightly provoked. Along with the explosion of the chloride there is no plasticity such as will facilitate its recurrence as there always is in the after-effects of exercise by living things." [5]

Yet the unwary are constantly trapped by such metaphors. No doubt the brain is necessary for memory, just as a brush is required for painting a picture, but neither the structure of the brush nor the state of the artist's muscles need be taken into account in a description of the painting. There is an easy way of avoiding all the difficulties in explaining the phenomena of memory beloved by those who are fond of pictures. When a mnemic phenomenon is studied by observation or introspection a diagram is drawn, and the various lines are called brain-tracts. At a future time it is ridiculously simple to suppose that the brain-tracts are the result of observation and that memory is explained by them. And those who come afterwards, and have forgotten how the diagram was made, naturally imagine that observation of the brain-tracts came first. It is only necessary to fall back on brain-paths to account for the phenomena of memory when a psychological explanation in terms of mnemic causality is shewn to be inadequate.

It has been demonstrated repeatedly, and indeed is a fact

of common knowledge, that meaning is immensely more effective than repetition in enabling a person to reproduce what has been learnt. The meaning of a passage ensures a great economy of energy in learning, by binding the different smaller units into larger significant wholes. In learning and reproduction these larger wholes serve as units. Mr D. O. Lyon [6] tested two persons with stanzas of poetry learnt at a single sitting with the following results.

Average no. of words	60	150	300	750	1500
Average no. of repetitions	6	15·5	17·5	19	26·5

These figures should be compared with those obtained by such practised learners as Ebbinghaus and Meumann who required 55 and 33 repetitions respectively to learn series of 36 nonsense-syllables. The enormous difference in the number of repetitions required in the case of nonsense and meaningful material is an indication of the disparity between the two factors previously described. The table also shews the great relative economy in learning longer passages, as though the meanings were synthesised into still larger wholes. Further, it has been shewn that after twenty-four hours the economy in relearning the same piece is greater with the longer than with the shorter passages.

We must now attempt to explain more precisely what occurs in memorising, bearing in mind that in order to remember we must first record. Such recording is not a mechanical process comparable with the making of a gramophone record. The temperament, interests, and attitudes of the person determine the content of what is recorded. As has been well said,[7] 'The cautious and the rash; the student and the man of affairs, the subject doubting and the same subject confident never perceive alike, though they may all be faced with exactly the same situation, so far as external features go.' Much of what is thought to be recorded at the time of learning is really supplied from the contents

of the subject's own mind, or inferred from what is given These considerations make it impossible to regard the act of recording as the fixing of a series of permanent memory traces in the brain or the mind, since the whole process is a developing, changing, one. To illustrate psychological processes we must go to biology not mechanics.

For in the process of recording the person must, above all, be active, if the content is to be remembered. In the chapter on "*Observation*" the importance of subjective activity was emphasised and a distinction drawn between seeing and observing. There is a similar distinction between hearing and listening. Neither seeing without observing nor hearing without listening can result in making any memory record Without conative and affective dispositions in the mind of the subject there is no possibility of remembering. In other words, learning cannot be acquired without the active co-operation of the learner. The material to be remembered must be assimilated with previously known material, and incorporated with the interests of the person into an organised whole. Memory is not mere reproduction; for processes of condensation, elaboration and invention are happening in the interval, making the act one of reconstruction rather than the re-excitation of lifeless permanent traces. Memory, being a living process, also involves the general attitudes and interests of the person, which, as they change from time to time also affect the manner and content of what is remembered. Various forms of reorganisation may happen as a result of this. The criterion of an efficient memory is, therefore, not exact reproduction (nor has this any educative value), but whether the reconstruction is appropriate to the changed circumstances. The bearing of this on the question of memory training will be considered later.

REMINISCENCE

Important facts have been brought to light by the investigation of delayed recall as compared with the immediate recollection of what has been partially learnt Dr P. B. Ballard carefully examined over 6,000 subjects, mainly children, and his investigations are of great importance in this connection, as they have served to bring to light a hitherto unsuspected recuperative power in memory. It is well known, both by observation and experiment, that there is a gradual fading or obliviscence of memory material, but reminiscence, or the process of improvement in the capacity to recall past experiences, escaped detection until experimental research made it clear. Dr Ballard [8] shewed that when a child has memorised a passage of poetry or prose, or even the shapes of a group of drawings he is, as a rule, able to remember more of it after a lapse of a few days than immediately after learning. The interest taken in the passage and its intelligibility determine the amount recovered, and under favourable conditions three-quarters of the children tested improved at the end of the second day The degree of improvement varies with the age of the subject from 6 years and upwards, whilst adults over 20 years of age do not appear to improve in the aggregate. If, however, the number of subjects who improve is considered instead of the average amount of improvement, then it was found that nearly 90 per cent of infants improve, 75 per cent of older children and about 30 per cent of training college students Improvement was shewn not only in the quantity remembered but also in the facility or speed of recall.

Now the total amount reproduced after an interval is the balance between what has been gained and lost, consequently the degree of reminiscence is, as a rule, greater than the degree of improvement Amongst the large number of classes of

children in the schools examined, although there was frequently a loss in the total amount remembered after an interval, in every instance some reminiscence was found.

The degree of reminiscence may be measured relatively by comparing the number of lines recovered after an interval with the number of lines originally remembered. Calculated in this way it diminishes amongst children with increasing age. If, however, the amount is measured absolutely by the total number of lines recovered, without reference to those originally remembered, the power of reminiscence improves up to the age of fifteen or sixteen years and then declines.

The improvement in the amount remembered increases till about the third or fourth day after learning, with infants of six years of age, it seems to attain its maximum after the second day with children of twelve, and is not manifested with adults. Reminiscence, however, as distinct from mere improvement, persists, and is found in college students as well as in children. This power of reminiscence is more active amongst older memory material and a systematic attempt to recall has a stimulating effect on the amount remembered. This is the psychological justification for the process of revision in learning. With regard to recently acquired material, reminiscence measured *relatively* seems to vary inversely with the extent of the subject's general mental equipment; being highest with mentally defectives. Amongst children of the same age there is, however, a distinct positive correlation between reminiscence measured *absolutely* and intelligence; the reverse is true of adults Immaturity rather than lack of intelligence is the basis of a high degree of reminiscence, and mental defectives behave in this respect like children of a lower age.

The phenomena of reminiscence make it evident that some active process, of a subliminal kind, is at work constantly changing the memory material. Memory is not a

passive process consisting in the preservation of traces, as on a gramophone record or a film, but a living active process. What has been once learnt, however difficult it may be to recover, influences our conscious life all the time. Past experience has a permanent effect on our thoughts and actions, even though conscious recall may not be possible. Although much of what is learnt at school is forgotten, it does not, in the least, follow that it has no influence on our subsequent life. On the contrary, it may effect the whole of our thinking, though little of it is consciously recoverable. A pupil who has been through a course of science, or literature, or any other school subject, has a different outlook by virtue of that training, and his judgments are permanently influenced. It is a shallow criticism, therefore, which objects to certain parts of the curriculum on the ground that these are not remembered after schooldays are over Let them go, the forgotten facts are not of much significance, and can be recovered if the desire to do so is there What is of lasting worth is the attitude of mind engendered during their acquisition, and the consequent effect exerted by the forgotten material on future activity.

THE EFFECT OF DISTRIBUTION

Experiments on learning nonsense-syllables have proved that the repetitions are more effective if they are distributed over several days than if they are continuous or made at one sitting. The most efficient method, for any individual, would be to distribute the repetitions at intervals corresponding to the times of his greatest reminiscent activity. In a long series of careful experiments on himself extending over a period of more than four years Mr D. O. Lyon [6] investigated the *total time* taken for memorising passages of prose and verse

of different lengths, and also nonsense-syllables and rows of digits. He compared the continuous method with the method of distributed repetitions (making one repetition only per day by the latter method), so as to discover the optimum distribution of time. A fundamental disparity was revealed between the results of learning material with meaning and that in which there is but little significance, namely the nonsense verses and digits, thus establishing once more an opposition between habit and memory. The total time taken by the distributed method for poetry and prose was nearly always as long as that taken by the continuous method, whereas for digits and nonsense-syllables in which there is no logical connection, there was a considerable saving in time by the once-per-day method. A similar opposition between the power of brute retention by mere habitual association and the active function of memory has been found in French school children of ten to thirteen years.

For both verse and prose, up to the limit of about one-thousand words, the total time taken, with either method, varied very roughly as the length of the passage An instructive reservation is to be made in interpreting this rule owing to the fact that we are dealing with units which have neither fixed length nor lines of demarcation between them, i.e. units of meaning. Such units are grasped as wholes in one span of consciousness Within certain narrow limits, therefore, the length of the passage does not influence the time taken for learning it, provided that the meaning can be grasped as a whole. In consonance with this, it was found that by neither method did the addition of a couple of extra lines to a stanza of verse make any perceptible difference in the time taken for learning, allowance being made for the longer time required for reading.

The chief advantage of the distributed method, for all kinds of material learnt, lies in the better retention which

occurs as a result of this procedure. A conclusion of great significance is that the most economical method of distributing single readings is to spread them over a rather lengthy period, the intervals being roughly in geometrical progression. For example, Lyon found that with a certain individual who memorised poems of twenty stanzas, the highest retentiveness was obtained by distributing the readings thus: 2 hours, 8 hours, 1 day, 2 days, 4 days, 8 days, 16 days, etc. Oblivescence is best prevented by reviving the memory when it is just beginning to fade away.

A comparison has been made[9] of the rate of decay, in psychological memory for material learnt by each of the above-named methods. The aim of the experiments was to discover whether the method of divided repetitions was more effective than that of accumulated repetitions, for the purpose of retaining logically connected material. Passages of history and economics were chosen, each assignment being from two to four pages of a book. The assignments were carefully marked, so as to get a record of the number of ideas contained in each, and the scoring was done by counting the number of ideas correctly recalled. No attention was paid to the correct recall of words, but simply to the meaning, and the figures in the table below indicate the percentages of such units of meaning.

There were thirty tests in history and thirty in economics, the subject-matter being consecutive throughout each series of tests so as to maintain logical continuity. Each assignment was read through five times, either at one sitting on the same day or once a day for five days, and then dismissed from the mind. At varying intervals after the reading, the subject wrote all that could be recalled without any assistance, and the percentages of retention for each interval was determined. The figures in the table are, in each case, the average of ten tests, five in economics and five in history, taken under similar conditions.

The results were:

Read.	*Tested.*	*Average amount recalled.*	
5 times in 1 day	next day	66%	—
Daily for 5 days	"	—	64·4%
5 times in 1 day	after 2 weeks	13·13%	—
Daily for 5 days	"	—	37·26%
5 times in 1 day	after 1 month	11·49%	—
Daily for 5 days	"	—	30·59%

It should be stated that results similar to these had previously been obtained by experiments performed on other observers who were trained psychologists. In all cases accumulated repetitions are as effective as divided repetitions provided that the ability to recall is tested one or two days afterwards. With longer periods a different tale is told, for the effect of the accumulated method wears off much more rapidly. Forgetting occurs very rapidly at first, but more especially with the material learned by the massed method; and in both cases slows down considerably as time progresses. The method of divided repetitions is seen to be of far greater value for prolonged retention

The reason for the superiority in retention obtained by the distributed method is to be sought in the facts of reminiscence. That the advantage is not due to the interference of fatigue, brought on by the massed method, has been shewn by experiments by Jost, in which a number of repetitions of *other* material was made before each of the distributed repetitions so that the total work on each occasion was the same whether the divided or massed method was used. Nevertheless, the superiority still rested with the former method.

Some active change is going on during the periods intervening between the repetitions which leads to better assimilation and organisation of the material to be remembered. There is, however, a limit to this process so that if, for instance, a single repetition is made every week the effect would be lost; and repetitions every fourth day are less effective than those

every third day, and so on up to the time of maximum reminiscence In other words, if the repetitions are made before the strength of reminiscence has begun to wane, the effect of divided repetitions is beneficial, and the memory is aided, otherwise the advantage of distribution is lost.

Different methods of memorising are employed by various individuals Amongst them we may notice the 'entire' or 'whole,' and the 'sectional' methods which are both forms of the continuous procedure previously considered. In the entire method the lesson to be learnt is read through from beginning to end until it is known, whilst in the other it is broken up into sections, each of which is learnt separately. There are numerous idiosyncrasies in procedure in this piecemeal method It will be easily seen that the sectional method introduces unnecessary and irrelevant associations between the beginning and end of each section. A 'mixed' method is more frequently employed, especially by school children, in which each section is learnt separately and then the whole is welded together from the beginning

The relative efficiency of the methods has been submitted on several occasions to experimental investigation. One of these experiments [10] was conducted on London school boys and girls of the ages of eleven and a half and twelve and a half in different schools By means of preliminary tests of memorising verse, the various classes were divided into equivalent memory groups One of the groups in each case then learnt selections of poetry by the 'whole' method and the other by the sectional method of learning line by line When both groups were tested it was found that the sectional method was better than the whole method, the amount that was retained being measured by the number of words correctly recalled. The conclusion arrived at was that there was a "conclusive victory" for the sectional procedure However, in two of the schools it appears to have been the normal

custom for the children to recite whole poems in chorus after the teacher, a procedure admirably calculated to destroy all interest and any desire ever to read poetry again. And in the case of one long poem, which is stated to have had continuity of meaning and a coherent story, the whole method proved to be the more advantageous No doubt in this case the interest in the story was responsible for the result.

In fact, where interest is aroused the method of learning is of far less importance than is usually supposed.

MEMORY AND INTEREST

Before we discuss the relation of interest to memory it will be as well to consider briefly the question of forgetting. According to the school of psycho-analysts the process of forgetting is not a passive one, but is a protective measure or repression by which we are screened from unpleasant recollections Thus it is said by the founder of the school that: [11] "the forgetting of impressions and experiences shews the working of the tendency to ward off from memory that which is unpleasant." By this principle he accounts for the forgetting of words, intentions, resolutions, etc., and he extends it so as to cover all erroneously carried-out actions such as slips of the tongue and pen. At the back of every such error there is said to be an intentional concealment or repression. In an examination of Professor Freud's contribution to psychological theory a very competent and sympathetic critic, the late Dr Rivers,[12] came to the conclusion that "there is much to be said for a view which would regard as a distinctive feature of Freud's system his theory of forgetting." He went on to say that it is forgetting rather than remembering which needs explanation and that "it is, perhaps, the greatest merit of Freud's theory that it provides us with such an explanation."

Now it is notorious that we often acutely remember what we consciously dislike, and would much prefer to forget, whilst, on the other hand, we frequently forget what we would desire strongly to retain. It might be expected that the distinctive contribution to psychological theory would provide an explanation. All that is offered, however, for normal persons, is an examination of cases of forgetting *isolated* impressions, and never an investigation into the obliviscence of organised groups of ideas, which is what an explanation should attempt. In the case of isolated things such as proper names, it is maintained that a forgotten or distorted name has some associative connection with an unconscious stream of thought. Of course everything in mental life has associations; it needed no theory from the vasty depths of unconsciousness to tell us that. And it is undeniably true that when ideas are associated the whole series fade away together. When we demand a reason for remembering unpleasant experiences in contradiction to the assumed principle we are told that a conscious intention to forget is powerless against an unconscious resistance. Dr Rivers endeavoured to rescue the principle we are considering, by the clever distinction between witting and unwitting repression, so that when we forget pleasant experiences we do so unwittingly.

The whole principle is, however, a mere *petitio principii*, for nothing more is meant by this school, when they speak of the unconscious, than a dark repository for forgotten experiences. When submitted to the test of experiment the principle that unpleasant feeling tone leads to forgetting, has been shewn to be unfounded. The experiment was conducted in the following fashion.[13] On the day after a half-term's holiday nearly seven hundred girls in a school, between the ages of eleven and sixteen years, were told to write down all the pleasant experiences of the holiday, and on the reverse side of the page all the unpleasant ones. About a fortnight later,

without any intermediate warning, they were asked to write similar reports about the same holiday. Any item found in the second report which did not appear in the first was ignored. In this way it was possible to discover the relative forgetting of pleasant and unpleasant experiences. Of 6,735 pleasant experiences originally recorded 2,700 or 40·1 per cent were forgotten; and of 3,491 unpleasant events 1406 or 39·8 per cent were omitted on the second occasion. The number of children who forgot a larger percentage of pleasant experiences was 345 and of unpleasant experiences 280, whilst 62 forgot an equal number of both. The experimenter concluded somewhat hastily, that there was no difference between the two feeling tones, pleasure and unpleasure, in their effect on memory. Similar investigations ought to be undertaken on adults, when the results could be checked by introspection. However, feeling does affect memory, as the following account of an experiment performed by the author of this book shews; but by no means in the simple way that the psycho-analytic principle would suggest.

Twenty-four men took part in the experiment, their ages ranging from 22 years to 38½ years, with an average of 26 years 3 months. They were all graduates, mostly in honours, being members of a practical class in psychology and they displayed great keenness on the experiment, five of them were men of considerable literary judgment. The material to be learnt consisted of four sonnets from Hardy's *Collected Poems* named "She to Him." The selection was determined partly by the sonnet form, which is useful in such investigations owing to the rigidity of its construction, which provides comparable tasks, and partly by the fact that these sonnets have exactly the same 'colour' and deal with the same order of ideas.

Each subject was given two of the sonnets to learn in a prescribed manner. The first was learnt by a 'mixed'

method according to the following plan, which insured that each line was repeated exactly eight times

	Plan of repetitions				*Total.*
First quatrain	4 .				8
Second quatrain	4	2		2	8
Sestette	. .		6		8

The second sonnet was learnt by the 'entire' method, being read through from beginning to end eight times; so that each line in both sonnets was repeated the same number of times. In the former case, however, as the plan shews, there were several irrelevant associations formed during the course of learning between the beginning and end of each quatrain and sestette which, theoretically, should interfere with the process of recall.

After each sonnet had been repeated in the way described, a couple of minutes' rest was taken, and then the accuracy of learning was tested. Each subject heard his neighbour who had repeated a different sonnet. A score was kept by recording the number of times that the person had to be prompted in order to repeat the poem, which serves as an index to the completeness of the learning One minute only was allowed at any point of hesitation, at the end of which the person was prompted, and every prompt was counted, even if it consisted only of a preposition or article. This rigid method explains the large numbers given later.

Everybody who has experimented on learning is well aware that there are certain places where different persons find exceptional difficulty in making associations. No explanation has been so far given of these 'refractory points,' but their existence calls in question the accuracy of any method of determining the completeness of what has been learnt,

which relies on counting the number of repetitions which are required to learn a passage All the extra repetitions necessary to break down the resistance at the refractory points are unnecessary as far as the rest of the passage is concerned, which is therefore overlearnt. Hence there is always considerable doubt in the comparative interpretation of results when the efficacy of a learning method is calculated by the number of repetitions necessary to insure perfect reproduction. The prompting method avoids this difficulty by fixing the number of repetitions in advance, and by not insisting on complete recall. In this way, the refractory points do not affect the other associations, but all are treated alike

The second part of the experiment was carried out exactly one week later In the intervening period the subjects were told to avoid thinking of the poems, as far as possible, and the instruction was successfully followed. At the end of seven days they were allowed to read each sonnet through once, from beginning to end, and one minute later the amount of retention was determined, exactly as before.

Immediately after the final record was made, each was asked to state which of the two sonnets he preferred. Nineteen subjects expressed a decided preference for one or the other; one liked both equally well; and four disliked both strongly, either because they did not appreciate them, or else because they thought them nonsense. If the different subjects are classified in groups, according to the sonnets they prefer, the effect of subjective preference on memory can be investigated.

The results are more clearly seen when exhibited in tabular form, where the average number of prompts for the group of five subjects who had no preference are given for the sake of comparison. The figures in heavy type in every case are those for the preferred sonnet ;

	Immediate recall		*Delayed recall*	
	I 'Mixed' method	*II* 'Entire' method	*I* 'Mixed' method	*II* 'Entire' method
Learned by				
8 subjects (preferring Sonnet I)				
Mean no. of prompts	**26**	40	**18**	33
11 subjects (preferring Sonnet II)				
Mean no. of prompts	43	**32**	40	**30**
5 subjects (no preference)				
Mean no of prompts	47	57	44	51

It is easily seen that, in all cases, the preferred sonnet is not only better learnt but better retained. These figures seem to suggest that it is not the method of learning which affects immediate memory or retention, but rather the subjective preference for what is learnt Statements have been made in conflict with this opinion, such as that of C S Myers,[14] who says that the mixed method, "although more economical as regards immediate memory, is surpassed by the entire method in respect of retention." Such a view appears to be the result of taking averages from disparate groups, or for dissimilar material, where the preferences cancel each other in the aggregate.

It follows from our investigation, that any experimental evidence about memory which does not take the subjective factor into account must be rejected. For, if the experiments are valid, it would appear that subjective preference is a *vera causa* The objection will at once be raised that "there is no cause or effect in nature, nature has but an individual existence, nature simply *is*", [15] and cause and effect are convenient fictions serving the purpose of economy of thought The concept of cause, we are told, is now replaced by the concept of function, and with the abolition of the causal concept the idea of activity must also be abandoned

However well founded this view may be in the realm of physical science, it is impossible to dispense with the notion

of subjective activity in psychology. If the psychologist finds it necessary to take into account the fact of thinking at all, and none except the behaviourist fails to do so, he is equally bound to postulate the activity of thought. Neglect of this consideration is due, as we have seen, to a physiological bias in psychology, by which function is regarded as determined by structure instead of *vice versa*. Mental structure is, however, simply crystallised function. From the psychological standpoint function is always prior, as we saw earlier in dealing with habit and heredity regarded as mental phenomena.

Now subjective preference is but another name for *interest*, and is a state of mind in which feeling-tone and conation are both prominent but in which the latter dominates the former. When we say that a person is interested in, or has a preference for, certain objects we imply that they arouse in him both feeling and desire. Whether the feeling is pleasurable or not is quite immaterial, for the strength of the interest is dependent on the desire. Hence we are led to the conclusion that the desire or will to remember is the essential determining factor in memory In this respect habit and memory are on a par, for in the preceding chapter evidence was brought to shew that the active attitude or the will to learn was necessary in order to acquire and retain a habit. Consequently whatever else is involved, effective memory training should ultimately be a training in sustained voluntary effort.

CAN MEMORY BE TRAINED ?

The question of memory training has long occupied the attention of teachers and writers on education. In a book on education written in the first century, Quintilian affirmed that the child's outstanding faculty was ' the memory ', which should, therefore, be carefully exercised to strengthen it.[16]

Right up to the nineteenth century this view was firmly held and acted upon. There was another reason for the survival of the belief, namely the paucity of school books for children, which naturally bred excessive reliance on rote learning as an easy plan by which they could be kept occupied. This plan tended to strengthen the view that memory was strongest in childhood. Now the child's memory appears strong mainly because his intellectual faculties generally are undeveloped; and it is far easier to get a child to learn by rote than to appeal to his understanding. It is, moreover, a fact that up to the age of eight or nine a child shews a fondness for mechanical repetition and reiteration. Advantage should be taken of this fact to get him to master the mechanical elements of reading, writing, and arithmetic, which involve considerable memorisation.[17] But this kind of work is considerably facilitated, and rendered interesting to the child, if play-way methods are employed and his love of routine fully utilised. Such methods are far removed from the incessant lifeless repetition which was long supposed to fix impressions firmly in the memory.

There is a dangerous complexity underlying the apparently simple question of training the memory, for several different things are mixed up together. First, we have the two main factors in every concrete act of memory mentioned at the beginning of the chapter. If we confine ourselves to true memory alone we have to disentangle several other factors involved in it. Dr W. B Carpenter[18] first pointed out that an act of memory depends not only on our ability to *retain*, but also on our ability to *record*, ideas, i.e. to commit them to memory, and finally on our power of *recovering* what has been so committed. Each of these factors is relatively distinct, and our simple question has consequently branched out into several directions.

As to retentiveness, the meagre evidence available for

physiological retention has been presented in the chapter on habit-formation, but as regards the psychological retention of ideas there is, as far as I am aware, no evidence to shew whether this is improvable by education or not. It is widely believed that our native retentiveness is as much an unchangeable property of our nervous system as its chemical constitution, a doctrine which is based on the view that all association is due to the formation of 'traces' in the brain, consisting of paths of low resistance between adjacent neurones which implies that all associations are of the mechanical habit type. But, as Dr Carpenter says, the associations "which are most useful to us in the acquirement of knowledge, and over the formation of which we have the most power, may be distinguished as *rational*; being based on the fundamental relations of the ideas themselves, the perception of which gives to the new idea a definite place in the fabric of our thought" Such connections as these between our ideas are the basis of all memorising that is truly educative, and it is not necessary to invoke the central nervous system in order to account for them.

For educational theory it is fortunately hardly necessary to consider whether retentiveness is or is not improvable, since pure tenacity of retention is not *per se* a valuable power of mind. If it is allowed to take the place of organised thinking, sheer retentiveness may be a bar to progress. This is very aptly illustrated by Professor C. Lloyd Morgan [19] in the following example: "I ask a boy who can readily learn a lot of dates when Jonson's *Every Man in his Humour* was published. He answers glibly 1596. I say: 'Was Shakespeare still living?' He looks confused, and I continue, 'Was Cromwell dead?' to his still greater confusion. And yet he can give me pat, if directly asked, the dates of Shakespeare's death and Cromwell's protectorate. He does not think but trusts to parrot-like association." This un-

fortunate youth has had his physiological memory trained, to the neglect of a systematic training in relationships, with the result that what he knows has no educational value " Another boy of whom the same question concerning Jonson's comedy is asked may reply : ' I do not remember the exact date, though I have seen it stated. But it was after the publication of the *Faerie Queene* and before *Bacon's Essays* appeared. I happen to remember those dates, so *Every Man in his Humour* must have been produced between 1599 and 1597.' His answer is less exact ; but it is more rational, and from the point of view of systematic knowledge of greater value."

There are, of course, a number of facts which must be known by rote, such as the tables, but a rational procedure in explaining them is the best method for remembering them and for future advance, as the methods employed in the best kindergartens have amply shewn Some other things to be remembered have neither rhyme nor reason, such as English spelling , but whilst these must be learnt, they have in themselves no educational value, except as a means to some further end. Rational associations within an organised system of knowledge are the only kind of retentiveness worth educational consideration It ought to be added that the systematic organisation of knowledge enables the material to be retained more readily, since each part of the system is retained by the combined suggestive power of all the rest. Moreover, as meaning is more readily assimilated than bare facts (as the work on retention of nonsense-syllables shews), and as the amount that can be retained in this way becomes incomparably greater, since a unit of meaning may contain many sub-units, the whole functioning as one without further effort , it follows that for practical purposes more complete organisation is equivalent to an increase of retentiveness Every new generalisation or law increases one's power of

retention, provided that it is arrived at by considering the particulars, for the mere statement of the law or rule implicitly revives all the particulars. The question of retentiveness has been much obscured by the false analogies used in discussing the subject, all of them drawn from the physical world, such as 'the store-house of the mind,' 'imprinting on the memory' and so forth All these, which are comparatively innocuous when we are considering physiological memory, are apt to lead to erroneous implications when true memory is discussed.

When we turn to the other factors, namely the recording and the recovering, further light is thrown on the subject of the training of the memory. There is no doubt whatever that the ability to record is improvable by practice; this has been shewn experimentally and indeed is obvious from general experience. For it depends on factors which are largely subjective and under our control; namely on properly adjusted attention, rhythm, control of imagery, etc. and also on our acquired interests. A problem of considerable educational importance emerges at this point, namely whether the improved ability brought about in this way is purely specific, or whether it is of a general nature so that it can operate in spheres outside that in which the improvement has been acquired. As this question is not confined to memory alone, but concerns all the powers of the mind, it is considered in the next chapter on *Mental Discipline.*

Finally, we have the third factor, namely, the capacity to recall what has been learnt. The name recollect which is usually given to this power is significant, for it calls attention to the dependence of memory on the will to learn. Recollection is to be contrasted with the kind of reminiscence which takes place in reverie, where we are relatively passive spectators of the flow of ideas. When, however, voluntary attention is concentrated on the details of an organised system of

knowledge, those associations are recalled which are relevant to the particular subject thought about. So that the condition of recollection, in so far as it is not subjective, brings us back again to the organisation of our knowledge, which is likewise the condition of its retention. "Most men," said William James,[20] "have a good memory for facts connected with their own pursuits The college athlete who remains a dunce at his books will astonish you by his knowledge of men's 'records' in various feats and games, and will be a walking dictionary of sporting statistics. The reason is that he is constantly going over these things in his mind, and comparing and making series of them. They form for him not so many odd facts, but a concept-system—so they stick So the merchant remembers prices, the politician other politicians' speeches and votes, with a copiousness which amazes outsiders, but which the amount of thinking they bestow on these subjects easily explains" It is evident that the real reason for the retentive memory in all these cases is the organisation of the facts brought about by an intense interest in them Putting it briefly, we may say that in the will to learn, and in the systematisation of our knowledge, lies the secret of training the memory In other words, there is no royal road to this goal, and instead of looking to specific exercises for this purpose we see that the proper method is to stimulate a desire for what is to be acquired, and to make our studies systematic

It is the universal custom amongst teachers to aid such systematisation by revising what has been taught Without revision to consolidate and organise lessons there is little chance of remembering. An investigation has been made of the effects on retention of various methods of revision[21] A series of geography lessons was given to three classes of children of about eleven years of age whose school attainments and intelligence were about the same. One of the classes

had a revision lesson at the end of the series, going over the notes, verifying places on maps and answering questions. The second revised their work by writing up their notes after consulting maps and asking questions of the teacher. In the third class some of the pupils prepared speeches after the manner of the *Play Way* and were cross-examined by their class-mates A test, constructed on the lines of a mental test, which could be rigidly marked, shewed that the last method was superior to the other methods of revision. This conclusion of the superiority of oral composition can only be accepted for young children, where no doubt the interest of the method combined with the free activity of the pupils serves to explain the result. A similar investigation for older pupils would throw further light on the question of training of the memory.

In the next chapter we consider the wider problem, indicated above, of training the mental faculties generally.

CHAPTER VIII

MENTAL DISCIPLINE

Historical Idea of Mental Training or Discipline—Experimental Evidence—Interpretation of the Experiments—New Evidence and Different Interpretations—Ideals

THE HISTORICAL IDEA OF MENTAL TRAINING OR DISCIPLINE

THE conception of mental discipline is at least as old as Plato, as may be seen from the seventh book of the *Republic*, in which Socrates is represented as persuading Glaucon in the following manner.

"And have you further observed that those who have a natural talent for calculation are generally sharp at every other kind of knowledge, and even the dull, if they have had an arithmetical training, although they may derive no other advantage from it, always become much sharper than they would otherwise have been?"

"Very true," he said.

Later on a similar conclusion is reached about geometry "The inhabitants of your fair city," says Socrates, "should by all means learn geometry Moreover the science has indirect effects which are not small."

"Of what kind?" he said

"There are the military advantages of which you spoke," I said; "and we know, of course, that the man who has studied geometry will be wholly and entirely superior to the

man who has not, with respect to the better apprehension of all subjects."

"Yes, indeed," he said, "there is an infinite difference between them "[1]

As soon as he appreciates the point, Glaucon fully agrees with Socrates, that not only does a training in mathematics make a man sharper at mathematics, but more acute in all departments of knowledge.

This notion of the indirect effects of education persisted throughout the centuries, for Bacon, in his essay on "Studies," doubtless influenced by Plato, also approved the doctrine, thus. "Nay, there is no stond or impediment in the wit, but may be wrought out by fit studies, like as diseases of the body may have appropriate exercises. . . . So if a man's wit be wandering, let him study the mathematics; for in demonstrations, if his wit be called away never so little, he must begin again If his wit be not apt to distinguish or find differences, let him study the schoolmen, for they are splitters of hairs."

The training here, too, is assumed to be of a general nature rather than specific, in that the splitting of dialectical hairs is thought to be a good preparation for enabling a man to split hairs of other sorts.

Locke put the matter much more succinctly. "I have mentioned mathematics as a way to settle in the mind a habit of reasoning closely and in train; not that I think it necessary that all men should be deep mathematicians, but that, having got the way of reasoning, which that study brings the mind to, they might be able to transfer it to other parts of knowledge as they shall have occasion." There was a good deal of inconsistency in Locke's views as to the effects of training, as he was largely guided by utilitarian considerations, maintaining in his *Thoughts Concerning Education* that mathematics should be studied for their great practical value.[2]

Nevertheless, the above statement may be taken as implying that the effects of training are of a general nature and not confined to the subject in which the training is received.

This doctrine once known as that of 'formal education' rests on the view that the assumption underlying the thought of all the above quotations has a solid foundation. In the great controversy in England in the middle of the nineteenth century, concerning the claims of natural science and modern languages to be included in the school curriculum, the warfare raged chiefly round this doctrine It was claimed by the adherents of the classical tradition that classics alone could furnish a liberal education, since they demanded a vigorous all-round exercise of the active, cognitive and æsthetic faculties They rejected the view that knowledge which had practical utility, or which might be considered as leading up to a profession, could have any educative effect on the mind. The classics were "regarded primarily as a species of mental gymnastics, a method of developing the intellectual faculties, without reference to the permanent utility of the knowledge conveyed" [3] This seemed to carry with it the notion, from which the extreme supporters did not shrink, that it was a strong recommendation for these studies that they were dry and distasteful to the pupils.

There was a firm belief all through the Victorian period that classics afforded a mental training or discipline superior to any which could be derived from other studies; and that mathematics occupied the second place. As Professor J. W. Adamson has pointed out, practices which have begun for one purpose often survive after the usefulness has diminished or disappeared; and in due course a doctrine is propounded which asserts the intrinsic excellence of such practices [5] The classics, from their long tradition in the schools, were defended on the ground that they strengthened the mind, to the exclusion of any intrinsic advantage attaching to their study

This is an admirable instance of the process of rationalisation. For the classics, and to a lesser extent the mathematics, were well-organised studies, whilst the new studies, especially science, were not sufficiently developed to be available for school purposes. Hence it was easy to be misled into thinking that there was some special disciplinary value in the classics denied to other subjects of the curriculum.

Girls suffered equally with boys under the yoke of the tradition, as in several schools they did not, nor were they expected to, get beyond the Latin declensions and conjugations, but the régime was defended on the ground that rote learning was such good mental training. The following actual dialogue between Royal Commissioners and a head mistress in the year 1866 illuminates the view.

"Do you find any difficulty in adequately teaching to a girl of ordinary intelligence three languages, such as French, German and Latin?"

"No; but then we confine ourselves to the elements of German and Latin, to the grammar of Latin, especially to the declensions and the verbs."

"With regard to Latin, does your experience lead you to attach importance to it as a means of preparing girls for the study of English or as a means of giving power to the mind?"

"I think it is in every way an excellent mental training."

"You think Latin grammar a very useful instrument for that purpose?"

"Yes."

"Do you find the girls learn it readily?"

"As readily as they learn any grammar. Grammar is a difficult subject."[4]

Other girls' schools, at that period, taught German in place of Latin; but, lest one should imagine that this was due to superior enlightenment, a distinguished head mistress[5] said that the girls derived as much benefit as the boys, for

"German, we think, answers the purpose of Latin, inasmuch as it has a complicated grammar"

A head master propounded the theory much more bluntly, declaring that it did not matter a bit what you taught a boy provided that he thoroughly detested it. The object of teaching the classics was, in short, to give the pupil a 'mental training' rather than any positive knowledge of the languages, for it was believed that a boy who knew Latin had obtained a master-key which he could apply to many a difficult lock besides But the supporters of the claims of natural science put forward similar views to justify their studies, one of the protagonists stating [6] that "the student of natural science is likely to bring with him to the study of philosophy, or politics, or business, or his profession, whatever it may be, a more active and original mind, a sounder judgment and a clearer head, in consequence of his study."

We shall now examine the theory that the effects of training in one sphere of activity can be, as Locke said, transferred to other different spheres, which as is now evident has at least the merit of respectable antiquity Is the wisdom of the ages justified ?

EXPERIMENTAL EVIDENCE

Cause and effect are especially difficult to distinguish in this connection and are frequently confused one with the other As Plato observed, those who are successful in certain branches of study or who have special aptitudes or abilities frequently have a better general capacity Instead of the special skill, however, having produced a better general capacity it may simply be an expression of such original general power. Thus clever boys in English public schools were usually placed on the classical side and naturally did

well there and afterwards, leading to the general belief amongst schoolmasters that there was some virtue in a classical training which fitted a boy to succeed in all departments of life

With the advent of experimental psychology certain methods were devised to cope with the problem, and although they have not given an unambiguous answer, at all events they have helped us to realise more clearly the issues involved and the great complexity of the subject. The earliest experiment of this nature is due to William James.[7] He considered but one aspect, namely, whether training in learning one type of poetry would shorten the time taken to learn an entirely different kind of poetry For eight successive days he learnt 158 lines of poetry by Victor Hugo, the total time required being 132 minutes Let us call this the test material or series He then learnt the whole of the first book of *Paradise Lost* in "20 odd minutes daily for 38 days" shewing that he must have had astonishing powers of retentiveness. This constitutes the practice material or series. Finally he tested himself on Victor Hugo's poem again and found that for 158 additional lines, "divided exactly as on the former occasion," he required 151 minutes for memorising. The loss in capacity was explained by the statement that he was "perceptibly fagged with other work at the time of the second batch of V. Hugo." Quite apart from this explanation, it is evident that the experiment is too crude and could not be regarded as evidence for transfer of the effects of practice even if the final conditions had been more favourable and the result positive. The method, however, is serviceable and indicates the direction along which experimental evidence has been sought.

Preliminary examination by the test material will hereafter be called taking the first cross-section, and the final test will be named the final cross-section. Any experiment on the transfer of the effects of training may be described as

taking a first cross-section by means of suitable test series, then giving a certain amount of training by the practice series, and finally a second cross-section is taken by means of material similar to the first test series

In order to overcome the difficulty of varying physical states and moods which vitiates the experiment of James, a refinement in procedure was introduced by Mr W H Winch, namely, the method of equal ability groups. By dealing with numbers of individuals, if some are more fatigued others may be fresher and so on School children were divided into groups of equal ability in memory, which was tested by their accuracy in reproducing a historical passage One of the teams was practised for a couple of weeks in learning poetry by heart, the other team had no practice of this sort. Finally the teams were combined, and a second cross-section was taken again by means of a historical passage The practised group acquitted themselves better than the untrained

Dr W G. Sleight [8] introduced further refinements into the experiments more especially in the statistical treatment of the results The improvement of one equal ability group as compared with another, as a result of practice, is usually expressed as a percentage of the initial ability. Such percentages are, however, misleading, for the greater the skill already attained the more difficult does it become to make further improvement. To meet this difficulty the amount of improvement is usually calculated in units of standard deviation as was done in a similar case in the chapter on *Observation* Another fact to be taken into account is that the first test itself gives a definite amount of training, which as our study of *Habit Formation* showed is likely to be greater than any equivalent amount of subsequent training. In order to compensate for this, only the differential improvement of the trained group over the untrained should be considered in drawing inferences

An experiment was made on 84 girls of average age 12

years 8 months, in three different schools. Each class was divided into four equal teams by different test series, arranged so as to be representative of the many different kinds of mental processes involved in memory, such as logical associations, reproduction of meaning, verbal and spatial associations, etc , and immediate and delayed recall were taken into account. The division into four groups of the same average mark constituted the first cross-section. One group had no special training, but the other groups were practised as follows group 2 learnt poetry by heart, group 3 learnt ' tables ' of various sorts; group 4 were trained intensively to reproduce the meaning of prose passages. Unfortunately, neither in the preliminary tests nor in the practice was any distinction drawn between the habit factor and the memory factor, and as we have previously seen it is unreasonable to expect a training in learning ' tables ' to influence the ability to reproduce meanings. At the end of six weeks a second cross-section was taken, each trained group having been treated similarly in all respects as regards the technique of training The conclusion of the whole matter was that there was nothing in the final cross-section to warrant the assumption of a general memory training as the result of specific practice. The effects of ' direct ' practice, as might have been expected, were found to be incomparably greater than the effects of ' indirect ' practice, and the latter did not last much beyond the period of practice. Six weeks, however, is not a very great time to influence general memory capacity, and the failure to discriminate between memory and habit makes the conclusions of doubtful value.

Experiments have been performed to try the effect of practising to discriminate shades of one colour on the subsequent ability to discriminate between shades of another colour, and a clear transfer effect was shewn.

Professors E. L. Thorndike and R. S. Woodworth made a

variety of experiments to find out whether there was any transfer effect of training in estimating areas, lengths and weights of various shapes and size, upon the ability to estimate areas, lengths and weights, similar in shape but different in size; different in shape but similar in size, and different in shape and size. Also, they tried to discover the influence of training in various forms of observation or perception upon slightly different forms. They found that practice in estimating the areas of rectangles from 10 to 100 square cms. resulted in a marked improvement. The improvement for areas of the same size but different shapes was 44 per cent as great; for areas of the same shape but larger, the improvement was only 30 per cent as much. For areas of different shape and different size the improvement was 52 per cent as great. Training in estimating weights from 40 to 120 grams produced only 39 per cent as much improvement in estimating weights from 120 to 1,800 grams, whilst training in estimating lines from ·5 to 1·5 inches long (resulting in a reduction of error of 25 per cent of the original amount) produced no improvement in the estimation of lines 6 to 12 inches long. Training in perceiving words containing e and s yielded an improvement in the speed of perception of other letters of 39 per cent as much as in the ability specially trained, but an improvement in accuracy of only 25 per cent as much. Training in perceiving English verbs yielded a reduction in time of nearly 21 per cent, and in omissions of 70 per cent, whereas the transferred effect in perceiving other parts of speech shewed a reduction in time of 3 per cent, but an increase in omissions of over 100 per cent.

The general inference drawn by these observers may be given in their own words, since it dominated educational thought on the subject and is still widely accepted. "Improvement in any single mental function need not improve the ability in functions commonly called by the same name. It may injure it. Improvement in any single mental function

rarely brings about equal improvement in any other function, no matter how similar, for the working of every mental function-group is conditioned by the nature of the data in each particular case." They concluded further, that as there was some loss of function even with a very slight change in the material, and as this loss became greater the more unlike the material became, it is " fair to infer that there is always a point where the loss is complete."

Such a conclusion is very risky, unless it is assumed that a mental act is always a mathematical function of its object, and even then the inference is not certain, as two values may approach each other asymptotically.

Results similar to those just considered have been found by other investigators.[9] Elementary school children were practised in multiplying numbers in their heads, whilst the first and second cross-sections were taken by means of standardised arithmetic tests, cancellation tests, learning vocabularies, etc. The second cross-section of the practised group, compared with equivalent control groups, shewed that the transferred effect was greatest in functions most closely related in content, and in functions where certain points of procedure were emphasised which were the same in the training series as in the test series. The gain from practice did not spread much to functions having little in common with the training either in content or procedure.

Another set of school children were trained to read paragraphs rapidly, and immediately afterwards to answer questions on what has been read, whereas the test material consisted of certain standardised reading tests and tests on the rapidity of perception of words, figures, etc. As before, the amount of transferred effect was small and depended on the similarity of the material and the method of scoring. Some of the transferred effect was due to better technique on the part of the pupils in dealing with tests, such as starting

promptly, suppressing excitement, learning to reply under test conditions, etc. Hence it has been suggested that in future experiments the untrained control group should have practice in dealing with neutral tests, in order to make the comparison fair It ought to be added that in the last two investigations just cited the practice periods were not more than two or three weeks , a most inadequate period on which to base conclusions.

Other observers [10] used as their practice material a code of simple geometrical forms. The principle of the code was explained to a group of students who, having learnt it, proceeded to transcribe prose passages into code symbols using their mental image as the key. For eleven days the group were practised for five minutes twice a day. The test series consisted of five different substitution tests, such as transcribing digits into code symbols, or substituting digits for letters, etc. One of the tests was the reverse of the practice material, consisting in transcribing code sentences into ordinary script. These tests and similar ones were given before and after the eleven days' practice both to this group and to a control group of students. No evidence in support of a transfer effect of the training was obtained.

An attempt has been made to discover whether the method of learning used during the practice period makes any difference to the transferred effects [11] For this purpose a simple code was constructed in which all the letters were represented by the figures 1 and 2, and was built up on a definite, simple plan One group of students had the letters in irregular order, and code figures before them whilst writing, but did not know the plan, nor indeed that there was any plan. The other group had the plan explained to them and memorised it, transcribing from the memory of the structure. Both groups were practised for 20 minutes daily for 12 days in transcription. It is evident that one group had a mechanical task, requiring

little intellectual effort; and the other a more rational task to perform, demanding concentrated attention. Each group had a preliminary test, the mechanical group in transcribing letters into digits and the rational in transcribing letters into a code. Similar tests were given at the end of the practice period. The experimenter concluded that a rational method of learning, involving the higher mental processes to a greater degree, yields a more definite transfer effect of training

Some recent experimental work [12] has been performed in which both the tasks for training and those for testing involved simple mechanical dexterity of the kind employed in factories. The subjects, who were adults about to go into industry, were paid both for improvement shewn in the tests and in the practice. As a result of a fortnight's daily practice for six hours a day in a very simple mechanical task no significant difference between the practice and the control group was found. The cultivation of one kind of manual skill does not seem to improve others of a very similar kind.

There is one obvious objection that may be taken to the experiments described up to this point. All pronounced mental change is subject to a law of inertia so that the results are not immediately apparent, but take time to manifest themselves. By this is meant not only the obvious fact that time is required for practice but also, and more important still, that time is wanted in the intervals of practice and subsequently in order that the effects of training may be displayed. During such intervals some change is going on in the unconscious mind, whereby a better organisation of our experiences is assured and they are more firmly knit into the fabric of our mental life. This is true of bodily equally with mental activities so that, as it has been well said, we learn to skate in the summer and to swim in the winter. The results of effective training cannot be forced.

Again, objection has been urged against the artificiality of

the experiments on the ground that the persons, however well inclined, take only a passing interest in the matter, and so the effects of the special training are sure to be negligible It has been rightly insisted that in order to demonstrate the results of education we should try to evaluate the effects which are produced by the actual studies carried on in the schoolroom in a normal fashion, instead of substituting artificial tasks under laboratory conditions There is much force in these criticisms and an attempt to meet them has been made by Professor Thorndike, who is again to the front in these researches, by an elaborate statistical investigation [13] He examined over eight thousand pupils in high schools in different towns, between the ages of fifteen to eighteen The first cross-section was taken by the teachers and consisted of a series of composite tests of intelligence of various kinds, chiefly aimed at measuring the abilities employed in language and mathematics, but not confined to these The final cross-section was taken by similar tests exactly one year later, so as to discover the difference made by a year's ordinary schooling in the abilities examined by the tests In order to eliminate the differences of practice value of the tests themselves, certain schools employed the tests in their final cross-section which were used in taking the first cross-section in other schools, and *vice versa* A record was made of the school subjects studied by the pupils and the gains made in the test were put into relation with the subjects studied. Thus the pupils who studied English, history, geometry and Latin (say) were compared with those who normally studied English, history, geometry and shop-work "If other factors . are properly equalised or allowed for, the difference in gain represents the difference between Latin and shop-work, as taught in these schools, in general training or disciplinary value"

The list of subjects studied by the pupils would appal

any but an American teacher as they ranged over modern drama, community civics, algebra, Greek, horticulture and radio. We learn also, to our dismay, that amongst a thousand pupils in one town there were over seven hundred different programmes of work. However, when we have recovered from all this, we find that the average gain in marks in the tests for the year was 23 (these marks being standardised so as to be of equal value at all points of the scale) of which it was estimated that about 12 were due to special practice in the tests, leaving 11 as the gain due to maturity and the disciplinary effect of the year's schooling. Seeing that there was a greater gain by the bare practice of taking the tests once, than was due both to maturity and training combined, these figures gave little positive support to the doctrine of transferred effects. The final result shewed that there was a positive relation between the presence of French or chemistry in a pupil's programme and gain in the tests, and a negative relation between the presence of cooking and sewing in a pupil's programme and gain in the tests. Some subjects, such as Spanish and English, shewed neither gain nor loss. To the positive side also belong trigonometry, physics, Latin, mathematics and history, in the order given; and to the negative side, drawing, business, civics, biology, stenography and economics in decreasing order of merit. It is gratifying to learn that it is bad to learn stenography and business in school, and economics and civics are also not above suspicion, if these statistical results are of any value. Though why English should have no effect at all is difficult to fathom, unless the secret lies in the way in which it was taught in these schools. An account of other experiments dealing with different aspects of the matter will be found in the author's book, *The Mind and its Body*.

INTERPRETATION OF THE EXPERIMENTS

It is now time to make some attempt to evaluate the evidence, which at first sight appears to be very conflicting. The currently accepted doctrine concerning the indirect effects of training is based on the following analysis. Both the test series and the practice series are believed to contain common elements of form or material or both, and these common elements may be called objective identities. There can also be identity of procedure or attitude in coping with the various problems, by which is meant an identity in the methods or technique employed in learning, in dispositions, modes of directing the attention or utilising rhythm, control of mental imagery and so forth. In contrast with the former identities these may be distinguished as subjective identities, being more or less under the subject's control.

Now it has been asserted repeatedly that, in all experimental cases where transference of the effects of training has been found to take place, an essential condition is the occurrence of identical elements of one or both categories, which the subject makes use of consciously or unwittingly. In the experiments on memorising, estimating lengths, using codes and the like the identical objective factors are said to be obvious. The curious cases of transference of effects in discriminating colours as a result of training in distinguishing musical tones, etc., are said to be explicable by the presence of identical subjective factors, such as better modes of directing the attention or avoiding distractions. But whilst common factors are a necessary condition they are not by themselves sufficient; for it is argued that the common elements must be separable from the complexes in which they occur if transfer of effects is to take place. As this process of disintegration can never be complete there must always be some loss in the

transferred effect, as was indeed noticed in many of the experimental results previously considered. Some observers have pointed out that certain common factors tend to facilitate the acquisition of a new activity whilst others interfere with it, and any transference is due to a balance between them.

A modified form of the identity theory is a refinement of the view of facilitation and interference.[14] Improvement in any mode of activity is considered to be due to the selection and weeding out of elemental abilities. When a new form of activity is undertaken the so-called elemental abilities are regrouped. In so far as the individual recognises the similarity or partial identity between the two activities, the elimination of the unnecessary elementary abilities and the regrouping of the others is more likely to occur. The analogy of a football side is used to explain this, where improved play may be due to greater unity of action. If a new team is constituted with a proportion of players from the old team, there will only be transfer of the improvement provided that the new side shakes down into good team work.

On the whole, the accepted view amongst experimenters is that identical subjective factors play the more important part, and these being given, differences in the material are of relatively little significance in hindering the transferred effect; which may take place in spite of great objective differences. The importance of the subjective factors has been well illustrated in an investigation on school children conducted by Professor C. H Judd. Two groups of boys were dealt with, and one was given a theoretical explanation of the refraction of light, whilst the other was left ignorant of the principle. The groups were practised in aiming with a dart at a target, seen at an angle, under twelve inches of water; and both groups did equally well. Theoretical knowledge of the law of refraction did not seem to be a substitute for the necessary practical skill. Then the conditions were changed and the depth of the water

was reduced from 12 to 4 inches. A marked difference was now manifested, for the boys who were ignorant of the principle of refraction were not aided much in coping with the new situation by their previously acquired practical skill On the other hand, the boys who knew the principle fitted themselves to the new conditions very rapidly. The subjective control of their movements, made possible by their theoretical knowledge, helped to secure effective transfer of the effects of training It will be remembered that similar results were obtained in the previously quoted experiments on the different methods of learning For, where a rational procedure was employed there was more evidence of transference. This provides experimental evidence, if that were necessary, that rule of thumb methods are devoid of general educative value

There is one function which is common to all mental processes, however different In considering such activities as remembering, imagining, perceiving, reasoning and the like, it is popularly supposed that the mental activities are diverse, whilst the objects referred to in the various acts are the same But there is no ground for believing in diverse kinds of mental activity, on the contrary, when the supposed faculties are thought to be different it will always be found that there are differences in the nature of the objects apprehended.[15] The subjective activity involved is in all cases the same, namely, the act of attention So that here we have, for what it is worth, a function which is common to all mental processes, and it is impossible that any real training can take place without mental activity No doubt facility of attention depends on the content attended to, and to that extent attention is specific. Experiments such as we have considered conducted for a period of days, weeks, or even a year, can hardly be expected to shew the influence of better adapted attention in yielding a better all round calibre of mind At

this point we seem to approach the limits of the experimental method in dealing with the problem of the permanent effects of education on general capacity, and we are compelled to fall back on the evidence of experience. It seems incredible that years of training with suitable intellectual material, adapted at each stage to the interest and capacity of the pupil, should fail to produce better all round capacity Whether the results are measurable is another story, and the question is only confused by experiments if the attempt is made to estimate intellectual calibre without regard to subjective preference or interests

But, if the experimental method has tended to narrow the issue unduly, the interpretation of the experimental results has made matters worse. All reference to common elements, factors, and everything of that sort, is psychological atavism. It is an attempt to breathe the breath of life into the dry bones of mental atomism. But these bones cannot live, for in place of a collection of disconnected elements somehow reduced to order by subsequent processes, a psychology which knows its own business ought to assert that continuity and form are present from the very beginning of conscious life. The whole argument of this book, up to the present chapter, has been a prolonged protest against the attempt to deal with ideas, images, sensations, etc. as though they consisted of isolated bits of mental furniture. Our conception of the continuity of the mental stream is equally valid for movements, and it is erroneous to suppose that a bodily habit, for instance, can be formed by the union of previously disconnected movements. No amount of "shaking down into team work" can account for the unity of action observable in a habit, if we suppose that the movements were originally disconnected

NEW EVIDENCE AND DIFFERENT INTERPRETATIONS

The whole question of the effects of training has been given a new turn by the researches of the *Gestalt* psychologists. It is rightly assumed, by this school, that a psychological or experienced whole is something more than a mere sum of its parts; in fact it may even stand in opposition to some of its parts. Thus an ape soon learns to secure a banana out of his reach, beyond the bars of his cage, by dragging it to himself with a stick. If, now, the food is placed in view of the ape in a drawer, with one of its sides missing, so placed that the open side is farthest from the bars of the cage, the animal tries to drag the food towards itself, but is prevented by the back of the drawer Professor W Kohler, who has observed the phenomenon very carefully, noticed that the more intelligent apes, after groping vainly for some time, *suddenly* changed their tactics, and pushed the food away from themselves out of the drawer and then round it towards themselves, in a smooth continuous curve.[16] The less intelligent animals required the drawer to be turned, so that the open end pointed more or less to the side, before they could grasp the situation That 'part' of the solution of the problem, which consists in pushing the food away, is not only in conflict with the instincts and previous training of the animal, but, regarded *by itself*, is in opposition to the problem of securing the food We must abandon the notion of separate elements or parts, and in order to understand behaviour in which ends are attained indirectly, by making detours which in themselves are in conflict with the ends sought, we must assume that the whole situation has a certain configuration or shape The solution of the problem only occurs when insight into the configuration is possible It is usual to talk of a flash of insight, and rightly so, for it has been shewn repeatedly that a true solution is always a sudden phenomenon, sharply contrasted with the blind groping due to

trial and error. The more one contemplates it, the more one realises, that the situation of the ape with the stick and the desired prize resembles that of a man with a pencil and a problem to be solved.

When the open side of the drawer in the above experiments is farthest away from the bars of the cage, its position with respect to the body of the animal may be described as 180°, but some of the apes do not achieve insight into the configuration unless the open side is turned more towards the body, i.e. into the position 135° or even 90° Now it was found that, if the animal succeeds in solving the problem in one of the easier positions, it will subsequently transfer the solution to the more difficult position One of the less intelligent apes proved quite unable to secure the food either in the position 180° or 135° but was successful at 90°. Immediately afterwards, when the position 135° was again tried, it achieved a prompt solution, and after that a solution at 180°. A month later, an unhesitating solution was accomplished at 180° at the very first trial. The interest in securing food, especially bananas, is no doubt a very powerful motive for these animals, sharpening their insight into the problem. But, unless we assume that schoolboys have less wit than apes, it would be a sad confession of impotence to believe that there can be no course of study sufficiently tempting to enable them to attain insight into situations other than those in which they are trained. Possibly the absence of general capacity, which used to be so much deplored, may be due to a lack of interest in school studies, so that the effects of school training depend to a great extent on stimulating interest in what is learnt. Bacon was not so far out when he asserted that 'impediments in the wit may be wrought out by fit studies,' but only on the condition that we interpret 'fit' to mean those that are fitted to appeal to the interest or aspiration of the pupils.

Just as a melody is something more than a mere series of

notes, or a sentence something different from a mere collection of words, so a problem is a different thing from the parts or elements into which it may be analysed ; it is a unitary whole. When a person, or an animal, learns to respond to a given situation, what determines his behaviour cannot be regarded as the elements of the situation, but must be viewed as insight into the meaning of the configuration as an integral whole. Professor Kohler has indeed changed the whole problem, by demonstrating the fact that insight into the relations within a configuration is the only means of securing effective general training

The experiments which he has devised are extremely simple in their application An animal is confronted with two situations and is trained to seek food with respect to one of them Let us call the situation which the animal seeks the ' positive ' and the one which he is trained to ignore the ' negative.' The animal is taught, let us say, to select the brighter of two greys, which may be easily done by placing equal quantities of food on two adjacent papers of these colours , and if he chooses the positive colour he is allowed to eat, if not he is chased away The procedure is carried out, as long as necessary, with the colours in different positions until the animal unhesitatingly chooses the positive colour. This constitutes our old practice series When the training has been brought to a successful issue a test series is given This time the ' positive ' colour is retained, but the ' negative ' is replaced by a grey which is brighter than the positive of the test series, and which may be called ' neutral,' since it has not appeared in the training series at all.

On the view that considers that transfer of the effects of training takes place in response to identical elements, or factors, in the new situation, we should expect the animal to choose the positive colour, as nothing can be more identical with itself than the same colour.

But four stupid hens observed by Professor Köhler refused to lend support to the theory, as they chose the neutral tint in fifty-nine tests out of eighty-five Our intelligent friends the apes chose a neutral-coloured box containing food practically every time, and a child who had been trained to select a certain positive box containing sweets, without making any false selection, a couple of days later invariably and unhesitatingly chose the neutral box. Educational psychologists, unlike the child and the clever animals, have chosen the identical elements in the training and test series, in order to account for the cases of transference of the effects of training: whereas, these experiments demonstrate that the choice is determined by the configuration or pattern of the situation, the animals responding to the relations between the colours in any particular situation Obviously, they have acquired insight into the relations of a perceived situation, and this enables them to cope with a new situation, in which they definitely *avoid* the identical element and respond to the configuration. It is as though they recognise that the melody is the same though some of the notes are different. Hence we may infer that, unless a task is carried out with insight into the configuration as a whole, the effects of training cannot be transferred. Otherwise the theory of mental discipline is sound enough, for the relations are universal, and insight into them places the individual at a standpoint from which he can view a new situation much more readily. We see also that training which consists of mere practice, however prolonged, is not discipline, for the latter implies understanding. Valuable indirect confirmation in support of the view here taken has been provided by experiments on the establishment of conditioned reflexes. Professor Pavlov [17] trained animals to respond, with fully formed reactions, to previously inadequate stimuli. His experiments led him to the conclusion that " any stimulus, after it had become a conditioned stimu-

lus, *was generalised*—that is to say, the conditioned reaction was provoked not only by the specially chosen stimulus, *but by any other of the same type* " (italics mine) If dogs and mice can respond to a generalised situation, it is preposterous to assert that this is impossible in the case of human beings.

IDEALS

An important consideration has yet to be dealt with. In all mental processes, the material employed in exercising the activity can be considered from the point of view of its worth or value to the person Experiments have been tried to discover whether the habit of producing neat work in one school subject, say arithmetic, will result in an improvement in the neatness by the scholars in other school subjects, e g language or spelling papers Although a great improvement was shewn in the arithmetic papers " the results were almost startling in their failure to shew the slightest improvement in language and spelling papers " Another observer, however, by carefully cultivating a special regard for neatness on the part of the children, and enlisting their regard for its value, found that improvement was shewn in directions other than the one especially trained

A review of the evidence which has now been presented leads us to realise that the whole problem of the effects of training must be viewed from a different angle We must turn from the sphere of psychology to the realm of ends. For, if immediate results are aimed at, without considering the ultimate aim of education, it is possible to acquire a high degree of particular skill without affecting general capacity. Where, on the other hand, an ideal is consciously pursued a motive is at work which is capable of changing the *whole* mental outlook, since it is of the nature of an ideal to engender

a 'divine discontent' with whatever falls short of it. To revert to our original example, a training in mathematics may produce exactness of thought in other departments of intellectual work, and a love of truth, provided that the training is of such a kind as to inculcate an ideal which the pupil values and strives to attain. Failing this, Glaucon's observation that he had "hardly ever known a mathematician who was capable of reasoning" is likely to be repeated.[18] In order to justify the universal tradition, which decrees that everybody should be taught mathematics, modern mathematicians are taking the line that the Greek view of the object of such study is the correct one, namely, "to make more easy the vision of the idea of good." As an eminent authority has well said, "Every great study is not only an end in itself, but also a means of creating and sustaining a lofty habit of mind · and this purpose should be kept always in view throughout the teaching and learning of mathematics" [19]

The following remarks made by a man who left the University and shortly afterwards was engaged as a missionary in the remote parts of Southern India, illuminate this point of view. "I entirely agree that Cambridge ought to provide us with learning, practical ability and character. Now Cambridge entirely failed to give me anything directly useful for my work. I learnt, for example, nothing whatever about South Indian devil-worship and demoniac possession; and of the many things which I did learn, hardly one is of any direct service. . . . And yet I have not a shadow of ill-feeling towards the University. . . . It is true that the learning supplied by Cambridge is here almost useless. The knowledge of Greek may have no commercial value to a missionary, and yet the learning of Greek must have had a share in producing a frame of mind which finds pleasure and satisfaction in mastering the intricacies of a language whose vocabulary is as large as that of Greek, and whose construction is as

idiomatic as that of French. It is true that practical ability is not greatly fostered by the Secretaryship of many Cambridge societies. But after all, the ultimate problems of organisation are concerned much more with men than with figures and diagrams." These pertinent observations help us to realise that there are other ways, than experiment and statistics, of evaluating the effects of education.

All roads thus converge to the same point, and it is evident that the ultimate aim of effective training is a moral one, consisting in loyalty to ideals A training which is confined solely to loyalty to an institution will not necessarily lead to moral conduct The love of a school, because it is ours, or because it has a fine tradition and a long history, is no doubt a stage in moral growth ; but only the first stage. If it stops at this point, the training is of limited value. The idea of honour, which is based on the approval or disapproval of a particular group of persons, is not necessarily a sound basis for moral conduct Co-operation in games and playing for one's side may indeed produce ideals of altruism and self-sacrifice in later years, but solely on the condition that the general tone of the school is sufficiently sound to make the pupils prize these as of exceeding worth. The motive must be allied to religion, or, at all events, rest on the conception of honour for honour's sake if it is to affect a person's whole outlook. By this means alone does 'playing the game' constitute a sound preparation for playing the game of living. If the ethos of the school is not in harmony with these ideals, very good team work is not incompatible with a subsequent narrow selfish outlook on life.

CHAPTER IX

SUGGESTION

Nature of Suggestion—Influence of Preperception—Personal Factor—Mental Content in Suggestion—Method and Suggestion

THE NATURE OF SUGGESTION

THE term suggestion is used with very different connotations in different contexts. Perhaps the most frequent use, in ordinary discourse as opposed to psychological or medical discussion, is in the sense of stimulating ideas Any book which stimulates reflection along the lines laid down by the author, or kindred lines, is said to be suggestive ; and in a similar manner a suggestive teacher is one who arouses reflection on definite lines, by making certain particular directions of thought appear interesting, or likely to lead to that which is interesting. In such cases the author or teacher conveys the impression that he has touched only the fringe of the subject or has given a bare hint of possibilities. The essential feature of this use of the term appears to be, that the process of association goes on smoothly and unconsciously along novel paths, without appreciable effort on the part of the person suggested. New lines of association are, as it were, opened up or new points of view indicated, which would not have occurred to the person if left to himself, but which occur unwittingly and seem luminously clear when the initial impulse is given by another person. In this case, the ideas aroused in the subject's mind

are, of course, his own, and he is exerting his own mental activity, though he would not have done so but for the suggestions given by the teacher.

When, however, the ideas themselves are introduced by another person, and their energy is not dependent on the subject's own activity, we are approaching the region of abnormal, or, at all events, of hypnotic suggestion. In this latter sense suggestion has been defined as " the intrusion into the mind of an idea, met with more or less opposition by the person, accepted uncritically at last, and realised unreflectively, almost mechanically "[1] The point of contact between these two different meanings of the term lies in the fact that the impulse to activity or belief is insinuated by another person. It is important to observe that, the first of the two meanings indicated above, i.e. the popular use of the term expresses the more fundamental idea of the phenomenon of suggestion, and the latter or medical use is an artificial one which tends to obscure the nature of the process. Perhaps the common meaning is best brought out by Dr Rivers's definition of the word suggestion as "a comprehensive term for the whole process whereby one mind acts on another unwittingly." The latter meaning is then a specialised and artificial variety of the general process of suggestion, the artificiality lying in the witting use of a process which normally occurs unwittingly.[2] For educational discussion the former meaning is the all important one, but the latter is not to be neglected, since there are regions of conduct or belief in the moral world where suggestion of the latter kind is educationally not only justifiable, but the most effective procedure to adopt. This is happily illustrated by the saying, attributed to Pascal, that men do not go to church because they are religious, but that they are religious because they go to church. So honour, duty, loyalty, etc may be cultivated by suggestions received from those around us who are honourable and loyal, and whose

example is infinitely more potent than any direct teaching can be

Much of our knowledge of suggestion is derived from a study of abnormal suggestibility, as illustrated by cases of hypnotic suggestion. Hypnosis is a drowsy or semi-drowsy state brought about by bodily relaxation and stillness, accompanied by the fixation of attention on some monotonous sight or sound, such as the ticking of a clock, or a light. Now it is believed that, in addition to the normal waking self, every person, normal or abnormal, has a sub-waking or secondary self sensitive to external impressions. In normal waking life the two selves are so completely co-ordinated as almost to blend into one, and the relation between them has been well compared with that of a broad stream in which there flows a current, with no fixed line of separation.

The hypnotic state is distinguished by the fact of dissociation, by which is meant that the secondary self is cut off, more or less completely, from the waking or primary self. When the person wakes from the state of hypnosis there is complete amnesia for the suggestions made to him in that condition, until the time comes to carry them out, when he acts in accordance with them, without realising their origin, and is under the impression that he is acting without constraint. If, then, he is challenged to give a reason for his action, he will usually invent one which makes his act more plausible to himself; in other words, he tries to rationalise his conduct. Conversely, in the hypnotic state there is amnesia for the events in the waking state, but a memory of the ideas or suggestions previously experienced during hypnosis. There are, as it were, two disaggregated streams of mental life each carrying its own memory. Now, when a person is hypnotised, i.e. when the control of his critical waking self is removed by causing dissociation, any suggestion made to him may be carried out in the subsequent waking condition, provided that

it is given emphatically, and repeated. The more direct the suggestion is made the better, and, as the suggestions are received uncritically, and carried out literally, any indirectness in the command will militate against the proper effect of the suggestion. These observations have been summarised in a so-called law of suggestibility, namely, that abnormal or hypnotic suggestibility varies as direct suggestion and inversely as indirect suggestion. In contrast with this an attempt has been made by Dr B Sidis to prove that in the waking state the effectiveness of a suggestion depends on its indirectness, so that normal suggestibility varies as indirect suggestion and inversely as direct suggestion. The method adopted to arrive at this law was to exhibit to the persons certain series of letters or figures, one at a time, arranged in various ways, or to shew series of coloured cards of various shapes or positions. Immediately after the exposure of a complete series, the person was required to write down whatever letter, figure or colour, according to the material used, occurred to his mind. By the arrangement, position or frequency of the letters or figures, and the more or less abnormal position of the coloured cards, or the surroundings, it was hoped to influence the subject's choice in definite directions. Sometimes a colour or a letter was verbally suggested whilst the subject was being shewn the objects It was found that the more the person realised that his choice was being determined, and this was especially the case with verbal suggestions, the more opposition was aroused so that the choice was contra-determined by the suggestion, hence the above rule.

The experiments, however, are not very convincing, and common experience, apparently, shews that for the great majority of normal people direct and repeated suggestion is effective. And the phenomena of crowd psychology shew that people will do what is most emphatically and directly suggested to them, despite their own immediate and remote

interests. How otherwise could the spread of advertising be accounted for? The purpose of an advertisement is to influence choice or belief uncritically This is sometimes veiled by more or less ingenious attempts to present the advertiser's reasons in a plausible form. Yet the suggestion to buy is followed by large numbers of people, who are perfectly well aware that the advertisement is designed to produce belief without critical thought. Thus, although normal persons appear to be suggestible in any sphere of conduct or belief in the inverse ratio of their knowledge, the rule is by no means absolute The utility of a transport company, for example, ought to be estimated by the comfort and convenience of the travellers, but they usually attract travellers successfully by publishing statistics of the large numbers who travel daily, though the larger the numbers the less the comfort of those who make use of the facilities The common "cold in the head" is the result of inflammation produced by foul air leading to congestion of the mucous membrane and may be alleviated by a current of fresh air, yet the vast majority of people avoid a draught because they are repeatedly told that this will bring a 'cold,' though the only method by which a current of cool air in a warm room can produce a 'cold' is by suggestion. Professor L. Hill the most competent authority on the subject has given the opinion that "A very great influence for ill acting on the health and stamina of children is the belief, current among all classes, traditionally handed down by grannies and mothers, and still taught in the advice given by many, if not most, medical practitioners, that exposure to cold is the great cause of illness. This belief leads to over-clothing and confinement indoors, over-coddling and debility of body, and weakening of nervous strength and stability."

THE INFLUENCE OF PREPERCEPTION

In the chapter on *Observation* the influence of preperception in determining our present thinking was described in detail and the section should be read again at this point. It is shewn there, that our present perceptions and ideas are determined to a considerable extent by expectations founded on our past experience. Binet [3] has made a special study of the influence of expectation, by experiments on school children, and has thereby added to our knowledge of the process of normal suggestibility. His procedure consisted of arousing a preconception in the mind of the individual scholar, with as little personal influence as possible, so that the idea was apparently auto-suggested. In other words, the scholars developed an idea, as a result of their experiences, which was then applied to later perceptions, where it did not fit. Such preconceived ideas, which function more or less automatically in later perceptions, are called by Binet directing ideas. He found that some scholars, and later observers have noted the same phenomenon in adults, behave like automata; they act constantly in accordance with the directing idea, without variation, whilst others who are also suggestible are not automatic, sometimes carrying out the idea and sometimes refraining.

It is, of course, obvious that all critical thought involves directing ideas by means of which the reflection is guided. The difference between critical thought and belief, and suggested ideas or actions lies, not in the presence of directing ideas but in their origin, and also in the fact that in the latter case the directing ideas are dissociated from the main stream of consciousness, forming part of the sub-waking self.

Suppose a series of lines of the following length namely, 12, 24, 36, 48, 60 mms. are drawn vertically, side by side, at about one centimetre apart. Anybody looking at the series will

immediately get the impression that the tops of the lines are growing in length at a uniform rate. It makes no difference to the impression of uniform growth whether the lines are exhibited simultaneously, or one after the other, at short intervals of time. Now Binet shewed such a series of lines successively, followed by about twenty or thirty others all of the length of the last line, i.e 60 mms. The children experimented upon were asked to indicate, by means of dots on a sheet of squared paper, drawn at appropriate heights above a base line, the length of each immediately after it was shewn. Nothing was said about the lengths of the lines, except that they were to observe carefully and shew the lengths that were exhibited as exactly as possible, and they were warned that some people went wrong and mistook the lengths shewn. Despite this warning, the great majority of the subjects continued to make the lines increase after the fifth, when in actual fact all the rest were of the same length. The idea given by the first five, that there is a regular increase of length through the whole series, becomes a directing idea against which most of the subjects struggle in vain. Subsequent investigation has proved that suggestibility, as shewn by this method, decreases in a regular manner between the ages of seven and twelve. Some children, indeed, especially young children and mentally defectives, continue to make the lines increase through the whole series. With the majority, however, there is a continual struggle between the directing suggested idea of increase and critical judgment, as shewn by the effort to draw what is actually seen. Examination of the individual performances demonstrates that children belong to different types and it is interesting to observe that the author of this book, experimenting in the same fashion, found these same types amongst university graduates.

Very few subjects resist the suggestion altogether, i.e. one or more lines after the fifth continue to shew an increase.

Some increase the length for several lines after the fifth, and then brusquely recover and throw off all suggestion in all the subsequent lines. Others correct themselves after acting on the suggestion for some time; but the corrections are not as great in value as the subsequent increases, i.e. the suggestion continues to act and correction is constantly made, but critical thought is too weak to counterbalance the suggestive effects; so that on the whole there is an increase in length till the end. A third type carry out the suggestion till the end of the series without correction, but the increments get smaller after a certain point. It is as though the suggestion had a certain momentum which it steadily loses, but there is no sudden recovery as in the case of the first type. The fourth or automatic type carry out the suggestion all through the series without correction, the increments being the same all through, so that there is a steady and regular increase of length from the first to the last line, exactly in accordance with the original model of the first five lines. But the most interesting group, and the most frequent, is that which may be called the rhythmical type. Just as with the first type these subjects brusquely correct themselves after carrying out the suggestion for a short time, but they immediately act on the suggestion again and then correct themselves, and so on until the end. Here there is a constant alternation between automatic action and critical thought, but unlike the second type there is no increase of length, but a sort of hovering round an average length. As was said above, this is the most frequently occurring type of normal suggestibility, and most subjects shew a tendency towards such a mode of reaction, even when they can be definitely assigned to one of the other groups. In short, suggestion follows the law of all living processes in being rhythmical. The periodicity of the rhythm varies from individual to individual but the results shew a continual alternation between automatic and critical response.

An experiment similar to the one described above on progressive lines has also been devised with progressive weights. A series of weights, looking exactly alike, is placed on a table and the pupils are instructed to lift each weight in turn to a certain height, and to say whether it is heavier or lighter than, or equal to, the preceding weight. The series is as follows, namely 20, 40, 60, 80, 100 grams followed by a further eleven weights all of 100 grams each: and it will be observed that the first five regularly increase so that a directing idea of progression throughout the series is suggested. In some experiments the method was varied slightly and the weight of the first box was stated to be 20 grams and the pupils had to guess the weight of all the succeeding boxes.

The sixth box in the series was frequently said to be lighter than its predecessor owing to the fact that the pupils expected a heavier box, and made too much effort in lifting it. Such a contrast between expectation and realisation is not uncommon in psychological work. But the notable feature to observe is that, not only was the weight of the sixth box mistaken, but the tenth and fifteenth were also frequently said to be lighter than their respective preceding boxes. This affords another instructive example of the rhythmical nature of mental activity, for an expectation once made tends to recur at periods, though the reality offers no justification for it.

If we compare the two different methods with the weights it will be seen that the latter is more difficult, for the subjects have to estimate the weights instead of merely deciding whether one is heavier than another. It was found that the pupils were more suggestible when dealing with the more difficult task. For the theory of education this is a point of fundamental importance, since if a suggestion is to be given to normal persons, the more difficult the task on which they are engaged the better. In fact, a casual suggestion made when the pupils are exerting their mental activity to the

utmost in some other direction, is much more likely to be effective than one made impressively when they are attending to it alone The reason for this lies in the fact that, by the former method, dissociation is brought about, so that the suggested idea appears as though it were auto-suggested. Hence it is often useful to introduce suggestions casually, whilst the pupils are intently engaged in their ordinary school work.

An important characteristic of action or belief, due to suggestion, is seen in carrying out experiments of the nature described above, and is equally evident both with children and adults In the case of the progressive series of lines it will be remembered that the subjects are not only told to draw what they see, but they are also warned that many go wrong. Nevertheless, it is found that nearly all subjects invent absurd reasons for their errors when these are pointed out to them. If they are pressed, they will give two or three different explanations of their conduct, none of which has any relation to the real reason which prompted them The obvious reason for continuing to make the progression is, either that they cannot help themselves, or that they were paying insufficient attention, but neither of these is ever adduced. This feature of the suggestible state is much more marked in hypnotic suggestion, but is a constant character of normal suggestibility. Again, it must be remembered that some persons take a suggestion for emotional reasons and others from intellectual causes, but in neither case is the real ground for action known to the subject

THE PERSONAL FACTOR

Experiments of the kind we have been discussing are apt to obscure what is perhaps the most important feature of suggestion, namely the personal element; this being the real

ultimate ground of all the phenomena. In many cases some object such as a diagram, a picture or written instructions convey suggestions which the subject carries out, and it is customary to contrast these as impersonal suggestions, with the more personal examples in which the suggestion is given verbally or proceeds by imitation. Sometimes, too, the suggestion appears to come directly from the subject's subwaking self. But in all these instances, i.e. both so-called impersonal and auto-suggestion, the personal factor is operative though, it may be, indirectly; and the only proper line of division is between direct and indirect suggestion. Binet's progressive lines and weights give rise to an apparently auto-suggested directing idea, solely because Binet himself has arranged the conditions, and he is ultimately responsible for the suggestion When any subject accepts the suggestion given by the lines, what is really influencing him is, not the objective figure, but the fact that he consciously or unconsciously supposes that the experimenter has drawn the lines with some purpose.

Where the personal factor is at a minimum, or operates through a set of pre-arranged conditions, we may call the suggestion indirect, whilst suggestions which are effective primarily owing to the authority or prestige of the person may be distinguished as direct. In the former case the personality of the experimenter is more or less in the background, whilst it is in the foreground in the latter. The chief difficulty ordinarily encountered in making a direct suggestion lies in the fact that it is apt to arouse opposition and result in contra-suggestibility. This is the reason that often makes direct moral training so ineffective with normal schoolboys. They resent any direct interference with their established code of conduct or their customary ideals, and consequently direct instruction about loyalty, honour, courage and so forth is either ignored or derided with some contemptuous term. Let

them, however, encounter examples of these as they occur in their normal school life, or in their reading of literature or history, or in some admired hero, and the state of affairs is immediately changed, they are now ready to approve of them with enthusiasm and adopt them as their own.

The conception of schoolboy honour referred to in the preceding paragraph is largely the result of tradition, and has been responsible for a good deal of harm Custom prescribes that a boy must never give information of anything occurring in the school which affects another boy, even though the happening is something evil. There are indications that some schoolmasters are dissatisfied with the results of this tradition, and are determined to challenge it on moral grounds. To do so requires much courage, and it will only be possible where there is a strong mutual affection between the master and his boys, so that he is really in *loco parentis*, and the boys are perfectly frank with him. The practical method of dealing with the situation by direct instruction has been so admirably expressed in a book by a schoolmaster [4] that a somewhat lengthy quotation is permissible. It must be premised that the author is speaking as a preparatory schoolmaster, but there is no reason to suppose that a similar procedure is not equally applicable by any housemaster.

After dealing with the paramount importance in all education of religious instruction he proceeds: "As soon as a boy has been in the school long enough for the Headmaster to feel certain he has gained his confidence and that he will talk to him freely and truthfully, he has his first serious talk with him. The period varies, of course, but usually it would be during a boy's second term At this first talk—the first of many—the Headmaster lays the foundation of all his future training. He must explain exactly what is meant by truth, honour and unselfishness, and what their value is in life. He must shew *why* one should be truthful, *why* unselfish, etc.;

it is not enough merely to lay down the law. For instance, it is easy to explain that our tendencies either get better or worse as we grow older. If a boy is inclined to tell lies and he continues to do so, he will grow up a man whom people cannot trust and therefore will lose his chance of doing his real share in the world. If, on the other hand, he learns how to be truthful, he will grow up a person in whom people have confidence and he will therefore have great opportunities for doing real good in whatever path of life he adopts This sort of idea, if developed with further examples, will very soon shew a child that telling lies for the sake of a passing or apparent benefit is a very poor idea compared to all that hangs on the habit of truth. He must be shewn, too, how closely allied are truth and beauty, and that beauty of spirit could not go side by side with falseness. It is so easy in such a talk to develop theme after theme which appeals to the child's natural love of beauty and idealism. Honour, being a comprehensive term, includes such things as purity of speech and action, decency and so on."

Now follows the break with tradition The boy having been shewn that the tone and reputation of the school depends on the character of the pupils, he goes on "Each boy must understand how his actions react for good or bad on someone else. Having made all this clear in much greater detail and at much greater length than it is possible to put on paper, the Master comes to the most difficult part of all. He explains to the boy that in most ways it is by his own example that he can help most, that if he and others succeed in bringing their characters up to the scratch, they are doing their job up to that point, simply by the force of example, than which there is nothing more infectious ; his friends will quite unconsciously do what he does in a great many ways ; it is the herd instinct. *But* he will point out, there is another way in which they can help more actively by direct co-operation with him. If ever

there were an offence against honour, for instance, if ever the boy heard another speaking or acting in a low or vulgar way or doing a mean or dishonourable action, he is expected to come and tell the Headmaster. The boy naturally hesitates, thinking that this would be sneaking. The Headmaster thereupon assures him that the last thing in the world he desires is sneaking and points out, for example, what 'sneaking' is, namely, when one boy reports another and gets him into trouble. If this should happen, the former would be sent about his business, and deservedly so What he is suggesting, however, is a very different thing, it applies to questions of Honour as explained—not to such matters as ordinary school rules, etc., and, *mark it well*, for this is the kernel of the whole thing—*there is no punishment.* In other words, if a bad thing, however elementary, happens in the school, it is an understood thing among all the boys that the Headmaster shall know—for one reason only, *in order that it may be put right.*"

The author of this quotation is firmly convinced on the basis of his experience, that the healthy schoolboy responds to such direct training, and he hopes by converting others to his view eventually "to root out the bad old conception of schoolboy honour and to substitute something higher, nobler, more inspiring," which will react on the whole of life.

All, however, depends on the personality of the master and his ability to impress the boys by his sincerity, so that they trust him absolutely. In order that instruction in such matters may be received with the minimum of opposition the person giving it must be endowed with sufficient prestige to keep contra-suggestibility within bounds Prestige may depend partly on position, authority, athletic ability and so on; but above all, to be effective in moral training, it requires transparent sincerity and conviction. Again, despite a popular belief to the contrary, schoolboys by no means despise

learning if it is carried easily, and accompanied by ability to control them; and a scholar possessed of this power carries much prestige, especially with older boys Always, the person as a whole is involved, and anybody lacking in personality and powers of discipline, however well endowed with other qualities, is incapable of any suggestive or direct influence on his pupils.

To return to our experimental observations, which may appear as an anti-climax after the above digression. A variant of the progressive-line experiment was included by Binet in his 'mental tests.' Six pairs of lines, each pair being drawn in the same straight line, are shewn consecutively; and, whilst in the first three pairs the right-hand line is always longer, in the last three it is of the same length as the left-hand line. The child tested is asked which of the two lines is longer in each pair. As a mental test of intelligence this particular example is now regarded as practically worthless, and in some versions of the mental tests is accordingly dropped out. Dr Burt, who applied this test to a large number of children, in schools of different status, noted the curious fact that such a test of suggestibility, and indeed other tests of critical shrewdness were relatively easier for children of inferior social circumstances. He explains the difference thus: [5] "The shrewd slum child unblushingly recognises that the examiner is setting a trap for him. The child of nicer manners hardly entertains such a suspicion, and conscientiously searches for minute differences." We must be on our guard against attributing to bare suggestion what is due to mere complaisance This was amusingly illustrated by a French child of seven, to whom a series of colours were shewn by a foreign lady working under Binet's directions. As each colour was displayed the child was asked to name it and afterwards to write the name, the suggestion that it was some other colour was made verbally whilst the child was writing, and he apparently accepted the suggestion.

Later he said to his teacher, "That lady is not French; in her country the colours are not the same as ours."

MENTAL CONTENT IN SUGGESTION

So far we have considered the effects of suggestion in influencing action or belief. But a more difficult problem arises when an attempt is made to investigate the suggestive consciousness itself. This may be illustrated by a tale told by Rayleigh in his observations on lighthouses. Tests were to be made on a new type of lighthouse lamp, which was to be substituted for the old at a prearranged moment. Several observers were on board a yacht taking notes and each wrote down independently his impressions Some thought the new lamp was an improvement, others thought it was the reverse. But when they got back to shore it was found that, owing to some misunderstanding, the change had never been made at all [6] Now, did these Trinity House brethren on the yacht experience a change in sensation, or did their mental imagery intervene so that they ignored the sensation and reacted to the image, or finally was the effect purely motor, so that they responded automatically, at the prearranged moment, by writing, in entire independence of their mental content? The last of the three possibilities named would imply that suggestion is merely an automatic response, in which the verbal suggestion can do the work of an adequate sensory stimulus.

It is obvious that it is only by the careful introspection of appropriately trained persons that we can hope to get some light on this question, and all discussion about suggestion in the absence of knowledge concerning the suggestible person's mental content is apt to be hazy. In some experiments to elucidate the point the subjects were university students or lecturers, highly trained in introspective psychology, and the

work extended over a period of two years.[7] The observers were informed that a stimulus would be given and then followed by a second, and they were to report when they felt the latter, or that a continually changing stimulus would be employed and they were to respond when they observed the change. In every case where a stimulus, or a change of stimulus, was employed its intensity was supraliminal, but the suggestions always ran counter to the actual stimuli employed. The kind of stimulus or change will best be appreciated by a couple of examples. A series of ten balls were dropped successively from a height and the observer had to state whether he heard the noise of the fall in each case. Eight of the balls were of lead giving a definitely supraliminal sound, and two of them, used in varying places in the series, were of cotton. Sometimes a white light of a given intensity was employed and its intensity was diminished so as to produce a noticeable change, but the observer was told that he was to report when he noticed an increase of brightness. Or again, the experimenter started with a red colour on a colour mixer, and gradually introduced yellow, but stated that he was introducing blue, and the observer had to state when he noticed the colour change. Control experiments were employed, in which the changes were what they were stated to be; but strangely enough this made no difference to the observer, for the replies given were the same in both the experiments and the controls.

There were ten subjects, five men and five women; seven were suspicious of the experiments, and all shewed from time to time that they thought that the investigation was other than it purported to be, namely an examination of their sensory acuity. Consequently they were ideal subjects to determine the point at issue.

The results of the experiments and introspections shewed that the observers were of three types; though as usual in psychological classification mixed types occur. The first kind

of suggestive consciousness may be called the motor-type in which the verbal suggestion is, as it were, carried across to the motor response immediately, as though the sensory data were irrelevant Many so-called sensory suggestions are of this nature. The muscular organs are in a state of tension ready to " go off of themselves " when the verbal suggestion is given by the experimenter With subjects of the second type there is stated to be considerable relevant mental imagery, corresponding to the suggestions made, i e. preperceived imagery which gives a new context to the stimulus The stimulus here is not the bare objective sensation, and the response made to it accordingly is the expression of an imaginally modified situation. Consequently, the subject is reacting not to the stimulus but to his own aroused images Finally, we have the sensory type where imagery is lacking, or is fleeting and irrelevant, and there is no motor preadaptation An instructive case in point illustrating this last type was furnished by one subject, who responded to a suggested unpleasant smell, in the absence of any odoriferous stimulus, by a watering of the eyes and the assertion that the odour was decidedly disagreeable The conclusion of the whole series of experiments is summed up thus· "In certain departments of sense, a verbal suggestion may arouse conscious processes which are, phenomenologically, identical with those ordinarily aroused by an adequate stimulus or change of stimulus." Only this type of suggestive consciousness furnishes evidence of a truly *sensory* suggestion

The importance of the above described observations lies in the fact that a similar state of affairs is probably met with on the ideational level, though there is no experimental evidence at present to confirm it. Investigation in this direction is the next obvious step to be taken in the understanding of the mental processes involved in suggestibility. When a person carries out a suggested idea we have no reason, at present, to assume that he has realised the idea or that he is

not acting in accordance with some other idea; since he may be of the motor type, responding automatically or of the imaginal type acting in response to a self-aroused idea. Only when we are certain that he belongs to the last of the three types can we be assured that the suggested idea is really operative in influencing his action or belief.

There is a popular belief that women are more suggestible than men, which is founded partly on the rapid spread of changes in fashion and dress, etc. But there is no convincing evidence in support of the belief. In the experiments we have dealt with in this and preceding sections no difference has been discerned between boys and girls or men and women. Moreover, if women are more liable than men to copy fashions in dress, we have no reason to suppose that they copy other things more readily. The assumption that a person who is more suggestible in one sphere of conduct or belief is therefore more suggestible in other spheres has no warrant in experimental observations, and it is in conflict with the trend of general psychology. We have long since abandoned the view that there is a general faculty of memory, imagination, reasoning and the like, but the notion of a general faculty of suggestibility dies hard. Common observation shews that a man may be abnormally suggestible in response to patent medicine advertisements, purchasing every new specific which comes on the market, yet in his business affairs he may be overcautious to his own detriment The study of physical science makes its devotees most critical in evaluating and accepting evidence for scientific phenomena, but some eminent physicists are notoriously hypersuggestible when dealing with such matters as telepathy. Where their emotional beliefs are brought into play

> "They'll take suggestion as a cat laps milk;
> They'll tell the clock to any business that
> We say befits the hour."

It is, in fact, only when the suggestions closely resemble one another that a person who is highly suggestible for one idea is apt to be suggestible for another. But there are limitations to this rule, so that even when the form of the test is exactly similar but the matter varies we must not assume that their suggestive effect is equal Experiments on a large number of men and women, in which each individual was tested with progressive lines and weights, in which the form is strictly comparable, shewed that " in spite of the close resemblance of the two tests, the coefficients of correlation (men ·16, women ·17), do not indicate that they are particularly apt to affect the same persons in a similar manner." [8]

METHOD AND SUGGESTION

From what has been said it will be apparent that some of the more important of the characteristics of hypnotic suggestion are to be found in the ordinary waking state. The chief of these is the uncritical acceptance of beliefs, moral standards, fashions, etc. which prevail in the various groups with which our life is bound up. Post-hypnotic suggestions are, as we have seen, realised unreflectively and almost unconsciously, for they appear at the time of acting to be the obvious course to adopt, and need no other justification than their own luminous self-evidence. And many of our ordinary beliefs are so much part and parcel of the very texture of our nature that the challenge to produce a reason is apt to lead to a natural irritation. We feel, rightly, that there are good enough reasons though we are unable to state them, and in consequence if we are forced to justify ourselves we, like the hypnotised subject, give any reasons which will make them appear more or less rational to other people.

This has been wittily expressed in the following para-

graphs.[9] "If we examine the mental furniture of the average man, we shall find it made up of a vast number of judgments of a very precise kind upon the subjects of very great variety, complexity and difficulty He will have fairly settled views upon the origin and nature of the universe, and upon what he will probably call its meaning, he will have conclusions as to what is to happen to him at death and after, as to what is and what should be the basis of conduct. He will know how the country should be governed, and why it is going to the dogs; why this piece of legislation is good, and that bad. He will have strong views upon military and naval strategy, the principles of taxation, the use of alcohol and vaccination, the treatment of influenza, the teaching of Greek, upon what is permissible in art, satisfactory in literature, and hopeful in science.

"The bulk of such opinions must necessarily be without rational basis, since many of them are concerned with problems admitted by the expert to be still unsolved, whilst as to the rest it is clear that the training and experience of no average man can qualify him to have any opinion upon them at all."

Mr W. Trotter, who is the author of this quotation, states that the only rational attitude towards these beliefs is that of suspended judgment. But surely such a position would be intolerable. If I have good reason to suppose that experts have demonstrated that boric acid (say) is a bad preservative for food, why should I not believe this and act on it until I can follow their arguments? No doubt, it is wiser for me to be ready to abandon a view when experts say that it is no longer tenable, but that is no reason for refusing to have a belief until I can prove it to demonstration Experts on relativity prove that the velocity of light is the maximum velocity that anybody can possibly have. It is easy enough to picture in imagination a velocity greater than this, but the

fact that such a concept leads to conclusions which the experts can shew to be absurd, though I cannot follow their arguments, is a good enough reason for adopting their beliefs In most of the practical affairs of life it would be ridiculous to suspend judgment until sound reasons can be brought to light. Many of our beliefs rest on reasons which we have long since ceased to envisage, and which in consequence would be difficult to produce, as they have lapsed into our subconscious life. There may nevertheless be valid reasons and we are justified in acting on them. If a person has a sovereign remedy for influenza the best thing for him is to use it with complete assurance in its efficacy, as in that way he may, at all events, get the benefit of a cure by suggestion. All this gives point to the advice tendered to a man of practical good sense, who, being appointed governor of a colony, had to preside in its court of justice without previous judicial practice or legal education The advice was to give his decision boldly, for it would probably be right, but never to venture on assigning reasons, for they would almost certainly be wrong [10] Every man is justified in acting on the assumption that he knows what should be the basis of moral conduct, even though the experts in ethics have never yet reached agreement, nor seem likely to do so. His real reasons are his conviction, that the course of his education and the approval of those whose opinion he values, are safer guides than any philosophical argument in all the ordinary affairs of life.

The question has sometimes been asked as to whether a teacher is justified in making suggestions about belief and conduct. The considerations dealt with previously have shewn that he cannot help himself, whilst, if he is fit to teach, he is thereby fitted to make suggestions, and the professional spirit of the teacher can be trusted not to abuse this authority. No pupil can be kept isolated from suggestions from those around him, whether in the sphere of religion,

literature, history and so forth. The attempt to teach the humanities impartially in the school would lead to a dull, uninspiring and worthless treatment. But the effort to make direct suggestions during the teaching of these subjects is more likely than not to arouse a spirit of contrariance and so defeat its own end This is the real safeguard of the pupil and the public against all biased instruction, and is much more effective than any regulation of the teacher's authority, for the scholars have an acquired immunity against direct suggestion more powerful than any artificial restraint on the profession.

A topic of considerable interest to teachers is the suggestive force of a question, or the extent to which the nature or form of the question produces a non-critical answer. Here, as in most of the topics concerned with suggestibility in normal persons, Binet did pioneer work His method was to exhibit a card, with certain objects attached to it, for a definite period, and then to ask a variety of questions about them. He had three forms of questionnaire which were written out and presented to the children who took part in the experiments, and they wrote their replies. Now one of the objects was an intact round button with four holes, which was stuck on the card with gum With regard to the button the following questions were asked in the three questionnaires · (1) How is it fixed to the card? Is it broken or whole? Draw it. (2) Isn't the button fixed to the card with cotton? Isn't it broken? Draw it. (3) There are four holes. What is the colour of the cotton which passes through the holes fixing the button to the card? Mark on a drawing the place where it is broken. It will be seen that these three forms are of varying suggestiveness and when the proportion of errors to the number of resistances was taken into account they were found to be progressively suggestive in the order here given.

The present author has tried experiments on this sort of

suggestibility in a somewhat different manner. A series of six drawings was made in each of which some object or part was missing. The subjects tested were sixty-three university graduates; and a couple of questions, one of them suggestive, was asked about each drawing. In every case, the first question either demanded a certain amount of critical thought, or else called attention to some actual feature in the picture. Thus one picture represented an artist standing in front of an easel, with a brush but no palette, and the subjects were asked, in the first place, to determine the nationality of the artist, and when this was done to state the shape of the palette. All the questions were given orally so that the personality of the experimenter was in the foreground, and at the end of the series they were invited to revise any answers which they thought were wrong. Only seven of the subjects proved to be completely non-suggestible right through the series. In several cases they grew suspicious at some point in the series as they were being repeatedly asked to describe something that was not there. Nevertheless it frequently happened that a subject, who suspected at some point in the series that suggestions were being made by the questions, was trapped at one or more later points The following figures shew the number of subjects who accepted the suggestion for each of the six pictures in the order in which they were shewn:

19	40	10	32	10	18

There is a rough kind of periodicity exhibited by this table indicating that periods of suggestibility alternate with intervals of resistance; thus yielding further evidence of the rhythmical nature of the suggestive state of consciousness

The suggestiveness of a question depends to some extent on its form. An important difference of form is seen by a comparison of the questions, "Did you see (hear, perceive, etc.) . . . ?" "Was there . . . ?" The former have been

called subjective-direction questions since they direct the attention of the subject to his relation to the object; whilst the latter are objective-direction questions since they direct the person's attention to the object observed, instead of to his observation All questions belong to one or other of these forms and it has been shewn that, on the whole, the suggestiveness of the former type of question is much greater than that of the latter. The introduction of the definite or indefinite article, or of a negative, into a question form also affects its suggestiveness in a somewhat complicated way.[11] Thus the change from the indefinite article to the definite decreases suggestiveness, whilst the introduction of a negative increases it.

We may pass next from the technique of questioning to the wider problem of method in education. Now there is no one method of teaching any topic, since method is relative not only to the subject-matter but to circumstances of age, capacity and so forth.

> "There are nine and sixty ways of constructing tribal lays
> And every single one of them is right."

Nevertheless, there are certain principles underlying all teaching which Dr M. W. Keatinge was the first to point out, and these may be considered as the foundations of general method.[12] There is first of all the principle of grading and demonstration whereby the teacher arranges his material systematically in such a manner as to make it suitable to the capacities of his pupils at any stage; the order and arrangement being fixed in advance. The order in which knowledge has grown in the history of the race offers much guidance here, for in the mental just as in the physiological realm phylogenesis offers the best clue to ontogenesis. A rigorous adherence to the order of the growth of knowledge is, however, to be deprecated, since the individual may be a mutation from the stock.

Moreover it has happened, more than once, that racial development of knowledge has taken a wrong or unfruitful direction. Thus the additive principle of arithmetic preceded the more fruitful development of the arabic notation with values determined by position, and it would be absurd to teach the former method because it was the first in order of time

The second general principle of method is that known as heurism, i e the method of placing the pupil, as far as may be, in the position of the discoverer. This method had a great vogue a generation ago and was responsible for a complete change in the method of elementary science teaching, substituting the more fruitful plan of dealing with problems for the more formal plan of dealing with the subjects in a strictly concatenated series of topics. Thus the pupil would be set the problem of discovering why, for instance, iron rusts, instead of waiting to deal with the matter until he studied the oxides of iron systematically The difficulty of such a plan is that the pupil can never really be placed in the attitude of the original discoverer, since he lacks the background of knowledge which the originator brings to his task. The fundamental error of the heuristic method consisted in the assumption that scientific method could be learnt by discovering the facts of science, whereas the facts of science can only be obtained by an application of scientific method. For scientific method, like all methods, does not work *in vacuo*, but is appreciated by studying the actual processes whereby science has grown Consequently, it is often valuable to allow pupils to work through some original investigation, not in ignorance of where it is leading or in order to acquire a knowledge of facts, but in order that he may discern the methods by which great discoveries have been made.

The third principle is that which is dealt with in this chapter, namely that of suggestion. " Method, then, as a whole comprises these three factors demonstration, heurism,

and suggestion. Their proportions may vary, sometimes one, sometimes another, taking the lead; but in all teaching which is to be effective, and especially for the guidance of conduct, suggestion must be given its due place. . . . When we are dealing with a train of reasoning, heurism is our surest method. In the elementary theory of arithmetic, for example, the pupil with a minimum of guidance can be made to do his own reasoning, and this holds good of experimental science, though to a smaller extent. In literary subjects, while heurism is by no means ruled out, demonstration and suggestion play a large part, and in all ethical teaching suggestion must be supreme. The whole art of the teacher consists in finding the exact blend of the three ingredients that will just suit his subject, his pupils and himself." [13] It must be borne in mind that whilst moral training may be an incidental product of good teaching in the humanities, yet the most suggestive moral instruction in school is that absorbed constantly and unconsciously from the general atmosphere and the personalities of the staff. The ethos of the school founded on its aspirations, traditions and history is essential in all moral education and the most potent means of suggestion. It acts in a personal way, for it is through living persons that the characteristic spirit of the school community is brought to bear on its pupils. Everything which helps to keep the past alive such as memorials, records, old boys' clubs, etc., gives a sense of continuity, which is important in quickening the spirit. Sooner or later, the feeling that he is a member of a community, with a record of service and achievement and a bearer of the tradition, makes itself felt as a powerful motive in all his conduct. For this reason schools with a long history and a roll of great personalities have a much greater chance of suggestion in determining action and belief than any other human institution, owing to the fact that they begin to exercise their influence at the most impressionable age.

CHAPTER X

PSYCHO-ANALYSIS

The Unconscious — Complexes — Psycho-analysis — Sexual Theory — Sexual Education

THE UNCONSCIOUS

In addition to his work for the treatment of nervous diseases, the world owes a debt to Professor Freud for the removal of certain taboos in dealing with questions relating to sex. A generation ago it was not possible to discuss these questions openly, with the consequence that adult guidance of the young in sexual matters was either non-existent or spasmodic. Nowadays the theories of psycho-analysis are very much in evidence not only in medicine but in psychology, anthropology, literature, the drama and the daily newspapers. Although these theories were derived from the study of neurotic persons, they are widely held to be applicable to all normal people. For this reason the student of educational psychology is bound to consider carefully the tenets of psycho-analysis, which claim to give an explanation of the contents both of the conscious and the unconscious mind, especially the latter. The first step is to get a clear view, if possible, of the much-abused term, the unconscious.

Most psycho-analytic literature is marked by the complete acceptance of the compartment theory of the mind which was described in the first chapter. According to this view, the unconscious is a topographical region in which are stored

up ideas, images, feelings and other mental furniture, of which the person is completely ignorant. The definition given by Dr W. H. R. Rivers [1] avoids this pitfall and forms a good starting point for the consideration of the meaning of the term. He limited it to such experience "as is not capable of being brought into the field of consciousness by any of the ordinary processes of memory or association, but can only be recalled under certain special conditions such as sleep, hypnotism, the method of free association, and certain pathological states." According to this usage of the word, the difference between the conscious and the unconscious is one of the degree of difficulty in bringing an idea or image into the mind. The term unconscious is thus a quality of particular mental events, not a region which they inhabit

Images or ideas which only function under such special conditions may, in this sense, be called unconscious, just as I may loosely call objects in a mist invisible, because I have to peer hard in order to distinguish them, and can only do so by a special effort. The case is analogous with the attempt to solve a mathematical or other problem. I may be totally unable to arrive at a solution at one time, but at a later period when certain difficulties have been cleared away, or when I have ceased to follow misleading trails, the solution suddenly emerges into consciousness. The fundamental blunder of psycho-analytic theory is the unwarranted assumption that the 'solution' existed in my mind from the beginning, in exactly the same manner in which I subsequently apprehended it. What really happens, however, is that owing to the removal of certain obstacles to thinking, or, it may be, to more effective understanding of the problem, my mind functions effectively and smoothly. The 'solution' is nothing but the smooth functioning, regarded from an objective standpoint Similarly, when I get up and walk my legs function smoothly unless they are cramped or diseased, but this

does not mean that I keep stored up in my muscles a set of motor images, which were suppressed when I was sitting. Walking, like the solution of the problem, is not bringing into play unconscious images, it is simply a name for the functioning of my leg muscles.

In order to make clear what is implied in the difficulty of functioning under abnormal conditions I may quote the case of a pupil of mine, a student of the German language, who suffered from intermittent amnesia. On one occasion he met the following sentence in a German book. "Stunden der Not vergiss, doch was sie dich lehrten, vergiss nicht" The idea appealed to him strongly, as it expressed concisely a thought of which he approved but had never quite formulated. He repeated the lines a few times in order to learn them, but found shortly afterwards that not only had he completely forgotten them, but he had forgotten the idea enshrined in them. After an interval he again made the attempt to learn them, with the same result. A prolonged examination, extending over a few weeks, revealed the fact that during the war the whole of his platoon except himself was killed in a night attack, and just before he himself was hit in the head, a particularly distressing incident involving his dearest friend had occurred. The combined shock, of the wound and the mental distress, brought about amnesia for the incident referred to, lasting for two and a half years It was evident that he had connected the words 'Stunden der Not' with the terrible incidents of the night attack, to which, in fact, they were peculiarly appropriate. The association thus established made it difficult for his memory to function smoothly with reference to the lines; owing, no doubt, to the agitation which made it difficult to concentrate, until, in the dreamy state preceding sleep, the agitation subsiding, he remembered the forgotten incident, when normal functioning was re-established.

Now in this particular case the forgetting was due to unpleasant associations, and the psycho-analytic doctrine of the unconscious is based on the belief that forgotten memories are all due to unpleasant feeling-tone. Yet who has not blushed for shame at the thought of some *faux pas* which he would gladly consign to oblivion if deliberate repression were within his power? The attempt to get over such difficulties by using a distinction made by Dr Rivers, between repression as a conscious process, and unwitting suppression, over-simplifies a very complex problem. Suppose I have learnt a stanza of poetry, by heart, and some time later attempt to repeat it, I find frequently that I am blocked for several lines because I am unable to remember a particular word or phrase. The cue which gives me the forgotten word enables me to recover the lost lines, by virtue of the law of association, whereby if one member of an associated group is presented, the others tend automatically to come into consciousness. There is no reason whatever to suppose, in such cases, that a particular unpleasant affect is attached to one part of the stanza which is absent from the rest. The supposition that there is such an affect for one section or phrase, is merely an attempt to save the theory that forgetting is due to unpleasant feeling-tone. But this is in flat contradiction with everyday experience, for the unpleasant emotion may be the last thing to survive when the intellectual components are difficult to remember. It is a common experience, for instance, to feel an intense dislike for a book, or a play, or a person, long after one has forgotten the reasons for the emotion, or, at all events, when it would be a matter of considerable difficulty to state the reasons definitely And, on the other hand, the reasons may survive in recollection, when the emotional tone has disappeared; as when we cease to dislike a person though we remember the original grounds of our aversion. Pleasant and unpleasant

experiences are forgotten (or remembered) with equal facility; but since, in the course of a normal life, the pleasant experiences must outweigh the unpleasant, the odds are greatly in favour of forgetting a greater number of pleasant experiences.[2]

We have, so far, dealt mainly with one meaning of the term unconscious. That is said to be unconscious which we recover either with great difficulty or under abnormal conditions. But by far the most frequent use of the word in psycho-analysis is, as was previously said, to indicate a compartment, or region, or system of the mind, rather than a quality of certain mental experiences. As Freud[3] has said in his latest work, "The word unconscious has more and more been made to mean a mental province rather than a quality which mental things have." And though he constantly hovers between the two uses of the term, he sees the inconsistency clearly, and declares that he "will no longer use the term 'unconscious' in the sense of a system, and to what we have hitherto called by that name we will give a better one . . . we will henceforth call it the 'id'." This impersonal pronoun is used to express the meaning that what belongs to the *id* or it, is completely independent of the ego; and it is an especially striking example of the fact that Freud is fond of converting functions or qualities into self-subsisting entities. There are numerous entities of this kind in psycho-analysis, all originating in certain hypostatised mental functions, such as the libido, the censor and so on. All of these are functions or qualities of mental processes, which, by a veritable miracle, become independent existing things. What has the *id* quality are repressed wishes, forgotten experiences and all the primitive instincts which have not yet found expression. All such instincts are supposed to be charged with energy ready to explode but kept down by the censor. The *id* is dominated by the pleasure principle, and takes no account of the consequences of action, provided that immediate

pleasure results from acting on the impulses. All repressed wishes and forgotten events are also subject to the same pleasure-principle. The refusal to act on this principle is said to be the reason for their submergence. Although most psycho-analysts believe that the pleasure principle is the basis of all human activity Freud does not, in his later writings, approve of this. He thinks that the interval between desire and action gives the person the opportunity of thinking, so that the ego " dethrones the pleasure principle, which exerts undisputed sway over the *id*, and substitutes the reality-principle which promises greater security and greater success." The most interesting mental events which have the *id* quality are the 'complexes,' to which we shall turn later.

In the meantime, it is instructive to inquire more closely into the anatomy of the mental personality as dissected by Freud. As is well known, he believes that people suffer from some form of neurosis owing to the conflict between the imperious demands of the instincts, and the internal repression of them by other considerations. The child has to learn to control his instincts, and indeed his bodily functions generally. The process is a gradual one and is never complete. In his earliest years he is restrained by parental authority, and in later years by teachers, institutions of all kinds, and in fact by the variety of educational influences which are brought to bear on him. By the combined influence of all these environmental influences he gradually builds up an attitude to certain anti-social forms of conduct, which we call conscience. Though we have spoken of this as due to educational influences, in the widest sense, it would be a grave error to think of the process as merely the imposition of a standard by external authority. For the normal person sooner or later accepts as reasonable the standards of right and wrong which he finds in society. They are in accordance with his aspirations; and he values them; not because they are imposed by authority, but because they

are suitable to his nature. Moral standards are in accordance, not with the pleasure principle, but with the reality-principle, reality being understood as comprising the moral realm. As Bishop Butler [4] long ago pointed out, "The fact appears to be, that we are constituted so as to condemn falsehood, unprovoked violence, injustice, and to approve of benevolence to some preferably to others, abstracted from all considerations which conduct is likeliest to produce an overbalance of happiness or misery"

Moral education consists, in the last analysis, of presenting such ideals to the developing personality as harmonise with the constitution of his moral human nature. Conscience, like any other human activity, grows and develops, but that fact does not affect its validity. And it is a mistake to think that, because we are not born with a ready-made conscience therefore it is something artificially superadded. Freud's account of conscience, or, as he calls it, the super-ego is very characteristic of his psychology, in that he erects it into a separate entity apart from the rest of mental life. In early life we are restrained by our parents, especially our father. But the child seeks to identify himself with his father, to be completely like him, so that he introjects the image of his father into his own consciousness. "The establishment of the super-ego can be described as a successful instance of identification with the parental function." Later on others, such as teachers or admired personalities, or even personalities in literature get incorporated into this father-image. So that conscience, or the super-ego, is the image of those we fear or revere whom we have identified with our own personality There is no doubt that conscience grows in some such way as this, so that we judge our own actions as they would be judged by those we respect and admire. But what Freud does is to replace this attitude of judging by a separate entity who judges He is so convinced of the reality

of this entity that he says, "I hope you will feel that in postulating the existence of a super-ego I have been describing a genuine structural entity, and have not been merely personifying an abstraction, such as conscience." But why the super-ego is less an abstraction than conscience is never explained.

COMPLEXES

We may now sum up the latest Freudian psychology in the founder's own words: "Goaded by the *id*, hemmed in by the super-ego, and rebuffed by reality, the ego struggles to cope with the task of reducing the forces and influences which work in it and upon it to some kind of harmony. . . . When the ego is forced to acknowledge its weakness, it breaks out into anxiety: reality anxiety in the face of the external world, moral anxiety in face of the super-ego, and neurotic anxiety in face of the strength and passions of the *id*." What complicates matters for the ego or person in this struggle is the existence of 'complexes,' which are said to be powerful determinants of action but are completely unconscious. This last point must be emphasised, for, according to psycho-analytic theory and practice, a person who has a complex is not only ignorant of its impulsive force, but of its very existence, though it is evident to anybody else except the victim. Much discussion has centred round the idea of a complex, and its connotation remains obscure in several points, though the man in the street employs the word with assurance. The term is used in both a narrower technical sense, and with a wider general meaning, but the two shade off into each other imperceptibly. In the wider use of the word there is nothing essentially morbid about a complex, which may be regarded as a constellation of psychical elements having their centre in

a common emotion, and functioning as a single whole with a definite conative trend. According to this usage any persistent idea or group of ideas, coloured with a strong emotional tinge, would be called a complex. This meaning of the term closely resembles the technical meaning of the word sentiment which is described by Mr A. F. Shand as an organised system of emotional impulses centred round some object, such as loyalty to one's school or college.[5]

Now a sentiment is a perfectly healthy and normal mental product, reducing to order and disciplining the emotional life, which without this organisation would be a chaos. A complex, on the other hand, has a certain irrationality both as regards the emotion, which is its nucleus, and as regards its impulse. The action to which it leads is inexplicable to an outside observer, and often to the subject himself, owing to the fact that the complex is not completely integrated with the man's personality. If we regarded lack of integration amongst a person's ideas as morbid, we should be forced to conclude that everybody is more or less pathological in his mental make-up, seeing that there is no sharp dividing line in this respect between the normal and the abnormal. As far as his specific complexes are concerned, a certain degree of irrationality is a universal characteristic of human nature. Everybody can easily detect complexes in others, but it is a property of a complex to prevent him from seeing those in his own constitution. The features of a complex, by which we recognise it in others, are that it disables the intellect from functioning normally in relation to any matters which touch the complex The person refuses to entertain ideas in conflict with the central thought of the complex ; for instance, those who have a materialistic-complex refuse to see any evidence of spiritual forces in the universe. Evidence which runs counter to the complex is rejected or neglected, or trifling excuses are made for avoiding it On the other hand, for

conclusions in conformity with the complex, any evidence is sufficient, thus sufferers from a telepathy-complex will accept as proof of their pet theme the wildest statements of notorious deceivers. This last phenomenon is due to the fact that although his opinions on matters touching the complex are entirely moulded by it, the person himself remains in ignorance of the fact that he is labouring under a complex [6]

The characteristic just named leads us to the narrower meaning of the term, in which a complex is considered as a pathological phenomenon. In this sense it is *completely* disintegrated from the rest of the personality and functions in isolation of the remaining mental content. Thus Professor Freud [7] defines a complex as "a circle of thoughts and interests of strong affective value of whose influence at the time nothing is known" to the subject; that is to say, it is an unconscious product. Such complete dissociation from the rest of the mind, which is said to be the result of suppression, gives to the complex considerable functional autonomy and the subject's behaviour is unpredictable to an abnormal degree.

The term 'complex' is peculiarly unfortunate since the distinguishing feature of a complex, compared with any other state of mind, is its extreme simplicity, and it ought in strictness to be called a 'simplex.' There is one complex, however, occupying a sort of intermediate position between the normal and pathological to which the name is applicable owing to its wide ramifications, namely the inferiority-complex.[8] It is probably universally found in some form or other amongst children, and persists in many adults. Dr A. Adler, who has described it very fully, maintains that it is the kernel of every neurosis or psychosis; and there is good reason to believe from the study of children in ordinary schools that it is the nucleus of many childhood fears.[9] Children who suffer from some form of maldevelopment or arrested development, such

as squint, errors of refraction, stuttering, deafness, adenoids, eneuresis nocturna, defective endocrine glands, or any other childish organ inferiority may, if not properly attended to, shew a tendency to neurotic or psychopathic states. If, as sometimes happens, their companions or relatives call attention to such somatic inferiority, and they feel their defect keenly, they are prone to contrast themselves with their more fortunate fellows and, feeling themselves insecure, they lose self-esteem and a sense of inferiority ensues. They are then apt to turn from reality and take refuge in protective devices, such as day-dreams, as a sort of compensation As they grow up they dwell more and more on their weakness, their malformations, they blame their education, their parents, their heredity and so forth Neurotic symptoms arise as a security against the too vivid realisation of their inferiority—anything in order to make life bearable rather than face reality squarely. The normal person also has his protective devices, and his flights from reality into phantasy, but in his case they are harmless fictions, whereas the neurotic fosters them and lives constantly in an imaginary world. As a compensation for his inferiority-complex he strives for mastery by devious routes and is unable, without medical help, to cope with life's situations. By perpetually relying on others he attains what, to him, appears a dominance over them, by securing their constant attention

This account of the origin of the inferiority-complex is strongly combated by Freud, who denies that the feeling of some organic disability is the cause of it. He maintains that the complex is developed owing to the failure to realise some ideal towards which the person is striving. The super-ego or conscience sets the standard which the individual strives to attain, or by which the person measures himself Any failure to come up to this standard results in an unconscious feeling of inferiority, which, if it continues long enough, may result in

the formation of the complex. This seems much more in accord with common experience, namely, that people who have an inferiority-complex are often to all external observation devoid of any obvious failing, physical or mental.

Dr A. Adler, the founder of Individual Psychology, has painted the picture of the neurotic constitution and its complexes with a few bold strokes "The consciousness of the weak point dominates the neurotic to such a degree that often without knowing it he begins to construct with all his might the protecting superstructure. Along with this his sensitiveness becomes more acute, he learns to pay attention to relationships which escape others, he exaggerates his cautiousness, begins to anticipate all sorts of disagreeable consequences in starting out to do something or in experiencing an injury, he endeavours to hear further and see further, belittles himself, becomes insatiable, economical, constantly strives to extend the boundaries of his influence and power and at the same time loses that peace of mind and freedom from prejudice which above all guarantees mental health. His mistrust of himself and others, his envy and maliciousness, become gradually more pronounced, aggressive and cruel tendencies which are to secure for him supremacy over his environment, gain the upper hand, or he endeavours to captivate and conquer others by means of greater obedience." [10]

PSYCHO-ANALYSIS

With the above preliminaries we are in a position to discuss the doctrines of psycho-analysis which we are assured, by its professors, are of immense importance to education It was at one time supposed that every nervous person must have something wrong with his bodily organs, although physicians could not discover what it was. Such persons often complain

of diverse specific pains, curious feelings, morbid fears and obsessions, and it was assumed that bodily causes were necessary to account for them When it was repeatedly found that they had neither heart, nor lung, nor digestive, nor other visceral weaknesses, it seemed natural to suppose that their nerves were weak, and Dr Beard an American physician accordingly described all such cases by a term denoting nerve weakness, namely neurasthenia.

It was discovered by Professor Charcot that, when hysterical persons were hypnotised, they could develop the symptoms of 'neurasthenia' by suggestion, and it was reasonably supposed that therefore they could be removed in the same way, i.e by mental as opposed to physical means, such as drugs Professor Freud studied under Charcot and his interest was thus directed to mental therapy Apparently, however, it was a patient of Dr J. Breuer's who hit upon the talking method of treating hysteria and other neuroses. This patient had been treated by various doctors by various approved methods, such as hot and cold baths, electricity, drugs, etc., without success It seems that she insisted on coming to Dr Breuer regularly to talk to him about all her symptoms, her domestic and other intimate troubles, her dreams and so on, in fact to talk at large without any suppressions whatever. After the patient physician had submitted to this course of talking without shewing undue signs of distress, he was surprised to find that the talker was beginning to lose all her hysterical symptoms. As he himself did not acquire them, despite the provocation, and the patient lost them, he naturally inferred that they had disappeared When Professor Freud was called in he conceived the happy idea of tapping the subconscious strata of the mind by the talking method, under the influence of hypnotism, for he thought that in this way he could arrive more rapidly at the origin of the symptoms. Accordingly Professors Breuer and Freud, working together, came to the

conclusion that many symptoms were entirely due to emotional causes, without accompanying physical nervous traumata. Subsequently, the suggestion part of the treatment by hypnosis was abandoned; but it is highly probable that in all cases, though they stoutly deny it, and whether they are aware of it or not, psycho-analysts do make use of suggestion.

The idea underlying Professors Breuer and Freud's treatment was that hysterical and other neurotic symptoms were due to forgotten emotional experiences of a highly painful nature, and it was believed that the recall of such memories would release the painful emotions associated with the experience, and thus the symptoms would be lost. They believed that if the patient could discover the origin of the symptom, the mere dragging it into the light of day would be sufficient to cause it to evaporate. Just as Aristotle thought that the representation of a tragedy, despite its horror, produced a healthy catharsis of the emotions, so it is said that this method of treatment leads to a healthy unburdening of the mind. The method has consequently been called the cathartic instead of the more descriptive but less implicative talking method; and the process whereby the talk is interpreted is known as psycho-analysis. It is, of course, assumed that only functional and not organic diseases of the mind can be treated in this way. I have no doubt too, that a serious talk with an adult who is trusted, as a parent, teacher or doctor, is infinitely preferable to brooding over disturbing experiences such as may occur during the early stages of adolescence. Such unburdening of the mind, if associated with a strong moral or religious appeal and the necessary explanation of the facts of sex, is the healthiest method of dealing with sex difficulties. But those who believe in the views of the psycho-analytic school are not suitable to undertake this task lest they corrupt the youthful mind, unwittingly, by suggesting their own theories. The reason for refusing to trust the psycho-

analysts is that they believe in what they call the Pleasure principle Professor Freud says: [11] "We may put the question whether a main purpose is discernible in the operation of the mental apparatus, and our first approach to an answer is that this purpose is directed to the attainment of pleasure. It seems that our entire psychical activity is bent upon *procuring pleasure* and *avoiding pain*, that it is automatically regulated by the *PLEASURE PRINCIPLE*."

We have seen that Freud has now abandoned this view, going "beyond the pleasure principle." His more recent opinion is that whilst the *ego* is guided by the reality principle, the *id* is wholly dominated by the pleasure principle "The *id* knows no values, no good and evil, no morality," but seeks the pleasure of gratification This is sound; for our primitive impulses are not concerned with the sphere of morals, since we share them with the lower animals. The instinctive life is on a different level from the moral life.

As a descriptive account of the behaviour of men the opposition between the reality principle and the pleasure principle expresses a real conflict, and the terminology in which it is expressed is valuable But I maintain that the psychological theory, which psycho-analysis has evolved to explain the conflict, is quite untenable, more especially when the pleasure principle is restricted to the region of the *id*. Our primitive or instinctive impulses to action are, at the outset, completely vague, but when they become definite they are aimed at specific goals in the real world, and not at abstractions like pleasure It is these real goals which they pursue and not the pleasure which results from attaining them. The ego may be attracted by pleasure, but the pleasure principle is perfectly powerless to direct the *id*. The sexual impulse, for example, yields intense pleasure whilst it is being satisfied, but it is only directed by pleasure when it has become fully conscious. Similarly of all other

primitive urges it is when the ego takes charge of them, and controls them, that we may be said to act on the pleasure principle.

The psycho-analytic theory is thus a complete reversal of the facts. For the *id* is directed to reality, only finding satisfaction when the urge attains a real goal The sexual urge, for instance, is directed to the opposite sex, and that is surely an example of seeking reality. The ego, on the other hand, may direct its activities by the pleasure principle, provided that the *id* has previously found reality The pleasure principle is later in order of development, and can only be explained on the basis of the pre-existing reality principle. To pursue pleasure one needs to be sophisticated The lower animals do not seek for pleasure; they aim at securing specific goals in the world of reality. Pleasure as a principle of action is an abstraction from pleasant realities

THE SEXUAL THEORY

We now turn to a doctrine which is of first importance in psycho-analysis, the sexual theory This, together with the doctrine of repression, constitutes the foundation of practically all psycho-analytic theory. On the basis of repressed infantile sexuality the whole superstructure has been reared. Professor Freud points out, correctly, that the sexual impulse is an appetite analogous to hunger and uses the term libido (craving) to express this resemblance.[12]

Now there are certain people, called inverts, who have sexual impulses towards members of their own sex, and in many cases the direction of their libido has been determined by something that occurred in their childhood, or at all events that is what they say during a psycho-analytical investigation. It is assumed that these and other sexual perversions,

being so widely spread, are congenital, and that normal sexual life is a mean between the extremes of perversion and repression. On the assumption of their congenital nature it is urged that we must search for the roots of perversion in the child, or in neurotics who "conserve the infantile state of their sexuality or return to it" Psycho-analytic views about infantile sexuality are either speculative, or else based on the study of neurotic persons with perverted sexuality. In other words it is a theory of psycho-neuroses based on neurotic persons' recollections of their own childhood, and not founded on the close observation of children From this point of view they challenge the popular belief that the sexual impulse is absent in childhood, and appears only in puberty, and maintain that this impulse is normal in childhood. They strive to shew that, only in this way, can we account for the widespread perversions and the homosexuality which was a feature of highly civilised Greek life. If this view were correct we should expect to find that the main cause of juvenile delinquency was sexual. Yet Mr Clarke-Hall,[13] a Metropolitan magistrate, in giving evidence on the subject, said that out of 49,915 youthful delinquents under 16 years of age proceeded against in children's courts in 1918 only 101 were for sex offences, i e. roughly 2 in a thousand. Normal persons know nothing about their infantile sexuality owing, it is said, to the amnesia of most childish experiences in later years, brought about by repression. Such amnesia "is responsible for the fact that one does not usually attribute any value to the infantile period in the developments of the sexual life." But psychopathic people distort their childish recollections, and, as Dr Adler has shewn, sometimes do this with a purpose

There is, according to Freud, a double wave of sexuality, the first crest appearing at three to five years of age and the second beginning to appear at puberty Between these periods

there is a time of latency, brought about by a combined conspiracy of all normal parents to do everything to repress the infantile sexuality. During the period of latency certain opposing forces are brought to play such as shame and moral and æsthetic demands, and "the erection of these dams in the civilised world is the work of Education" It is further assumed, without any attempt at proof, that all the energy of a human being is derived from the sexual impulse, i e. diverted sexual energy, and this diversion into other channels begins to take place during the period of latency "Such deviations of sexual motive powers from sexual aims to new aims, a process which merits the name of *sublimation*, has furnished powerful components for all cultural accomplishments." That is to say that the energy which goes to the development of an individual from his babyhood onwards, is derived from sexual sources.

The process of sublimation, the diversion of energy into social and moral directions, instead of dissipating it or using it for lower ends, is one of the aims of education, and the purpose underlying such organisations as the boy scouts, girl guides, church lads' brigades, and so on. These admirable outlets for activity undoubtedly appeal to an urgent demand of youthful human nature, as is indicated by the fact that they have spread over the whole globe. The assumption that all the energy is diverted sexuality is a mistaken inference of the Freudian school, due to the too-ready acceptance of their patients' statements, and the belief that such people are fair representatives of normal human nature. Fortunately we have the statement of a psycho-analyst of other views who, with the same kind of patient, takes a very different attitude, and is consequently able to evaluate the evidence. Dr Adler says · "It is easy for the neurotic to convince himself that he is the subject of a high sexual tension by means of a more or less purposeful arrangement, and especially by means of

a concentration of attention in this direction the moment he begins to seek proof of how much injury sexuality works to his feeling of security and how much his personality is threatened from this source . . . The later psychic perverse tendencies derive their material and impulse from the harmless bodily sensations and misjudgments of childhood which when occasion arises are given an extraordinarily high value, or some chance pleasurable sensations are perceived as analogues of sexual sensations. The psychologist must not assume the same point of view, must not maintain such a mode of apperception as valid, not substitute real sexual components for a fiction as the patient does His task, on the contrary, consists in revealing to the patient the superficiality of his attempts at orientation, to tear it apart as a mere product of the imagination "[14] Our task also as teachers is to reveal to our pupils higher goals towards which they should strive, and, whilst respecting individuality and their point of view, to refuse to be led aside by any doctrine which teaches that perverse or immature human nature should set the standard for healthy living

Freudians are convinced that babies are sexually active at three or four years of age. But as there are no facts to support this strange belief we are presented with a few terms and theories to fill the gap Any portion of the skin or mucous membrane which yields a feeling of pleasure when stimulated, is described as an erogenous zone, which seems to be founded on the theory that all pleasure must be of a sexual nature. Certain definite parts of the body are obviously erogenous, but this is not enough to demonstrate infantile sexuality, so we are stimulated to accept the theory by applying the epithet to other parts, for we are told[15] that "any other region of skin or mucous membrane may assume the functions of an erogenous zone" All parts of the surface, inner or outer, may thus be erogenous zones. Little wonder, then,

that the typical instance of infantile sexuality which Freud examines at length is the innocent but annoying pastime of thumb-sucking! This, which we have hitherto regarded as neutral from the point of view of sex, turns out to be the very type of a sexual act. Not only is thumb-sucking of this nature, but as the skin is pleasurably stimulated by the jolting of railway carriages, travelling too must be sexual. Lest anyone should think that this is a manufactured illustration I quote Professor Freud's own words "The shaking sensation experienced in wagons and railroad trains exerts such a fascinating influence on older children, that all boys, at least once in their lives, want to become conductors and drivers. . . . The desire to connect railroad travelling with sexuality apparently originates from the pleasurable character of the sensation of motion" Comment on this seems entirely superfluous; but the complete lack of humour displayed is due to the fact that psycho-analysts infer children's reactions from analysing sexually perverted adults, for, he admits [16] that his views on "infantile sexuality were justified in the main through the results of psycho-analytic investigation in adults." He maintains, however, that the results are confirmed by the study of nervous diseases in children. His evidence for this has been examined by Dr Wohlgemüth,[17] who has shewn conclusively that the case on which Professor Freud relied was due to the outrageous suggestion of morbid sexual ideas by a psycho-analytic parent to his small boy.

The psycho-analysts have not attempted to add observation on healthy children to their doctrines but have contented themselves with repeating their master's *dicta*. The most prominent English exponent,[18] for example, maintains, without a shadow of an attempt to justify the view, that ignorance of the facts of sex "is never primary, but is based on repression and forgetting of earlier knowledge and speculation in childhood." Speculation on sexual matters before the

age of five! In order that there may be no doubt in our minds as to the activities of these speculative philosophers the same authority tells us that psycho-analysis shews that, "It is almost a regular occurrence for children of the age of four or five to turn from their parents, to withdraw into themselves, and to pursue private speculations about the topics concerning which they have been denied information, whether by direct refusal or by evasion"

This view of what happens in childhood is not founded upon a close study of children It is a psychological blunder to read back into children what we learn from adult mentality. More especially, the notion of repressed infantile sexuality is an incorrect inference Many people of both sexes can recall isolated agreeable sensations connected with the genital regions from an early age But, as Havelock Ellis [19] has pointed out, these memories are, by no means, repressed. "What is repressed, and usually not indeed experienced, is the impulse to mention them to grown up persons, and they are commonly not mentioned to anyone. But they tend to persist in memory, because they stand out of relation to ordinary experience and in striking contrast to it."

Lacking a sense of humour, many psycho-analysts seem unable to understand children's ideas. It will sorely perplex this school to learn that there is as little that is sexual even in a young child's masturbation as in his playing with his toes or his toys. And when a child asks "Where do I come from?" it is perfectly stupid to imagine that this is a sexual question; for he is equally interested to know where birds come from and who made trees; and this boundless inquisitiveness all has its origin in the same root of natural instinctive curiosity. The only way to discover what a child's questions mean is to observe children closely, and not to infer their meaning by what neurotic adults tell us from distorted recollections of their own childhood. For-

tunately we have a record of a close study of his own children by a very competent Danish observer who brought up his girls at home and made careful notes of their development for the first few years, thereby making a valuable contribution to child psychology.[20] At the age of four years one month one of the girls asked her mother, "How are ladies made?" The rest must be given in the father's own words. "Her mother, startled at the question, inquired 'Why do you ask?' But R had her good reasons, and said 'Because there's meat on ladies.' To make sure of her meaning, her mother demanded 'Which ladies?' and received the answer 'You and other ladies.' It being thus placed beyond all doubt that what R desired was general information relating to the origin of ladies, she received the unsatisfactory answer 'I don't know.' R. being thus thrown back on her own resources remarked 'I think it's a meat-man, don't you?' It is rather obscure what she meant, but I assume that she possessed a vague notion that ladies—in whom 'meat' struck her as a salient characteristic—were manufactured by a person analogous to what she called a meat-man."

Luckily the father was not a psycho-analyst, and so the child's responses were not distorted, consequently we are able dimly to see what the child is speculating on, and it is perfectly clear that it has nothing whatever to do with sex. The same child at the same time wanted to know "Who made the birds?" and it was obvious that she regarded creation and birth as a kind of *fashioning*. What is there sexual about this? At the age of four years and ten months she made the inquiry: "Where's the child now which the lady is going to have in the summer?" "Her mother replied 'In the stomach of the lady.' This evidently appeared to R. somewhat peculiar, for, after a pause for reflection, she asked: 'Has she eaten it then?' Her mother answered: 'No'; but R. persisted: 'Does it come out of the mouth?' Her

mother, realising that there was no escape, at last answered 'No, it comes out of the tail' (this was the children's expression to indicate the part in question). This truthful explanation contented R" If anyone will compare this conversation of healthy-minded parents with Freud's account of the analysis of a five-year-old boy [21] to whom a misguided father made the most repulsive suggestions, he will be wary of expecting guidance in education from psycho-analytic sources The Danish father rightly remarks that he cannot see why a child should feel shocked at being told the truth, and his children were obviously satisfied and pleased He observed, too, "that the birth of children is connected with the *marriage* of the parents is not understood at all by the child of the age under discussion." In other words, there is nothing sexual about the child's idea of marriage; and the less that is said about infantile sexuality the nearer we shall approach to the child's point of view Havelock Ellis, who is in sympathy with some of the tenets of psycho-analysis when applied to some adults, thinks that "when we survey the manifestations of infancy and childhood we see that in relation to sex they may sometimes be apparently non-existent, when present are usually vague, and when definite are frequently not to be explained in the way they would be explained if occurring in an adult."

If the view taken of the child's mental life is completely distorted, the same can be said of the psycho-analytic view of the adult's moral life There seems good reason to believe that the various forms of psycho-neurosis such as anxiety neurosis, hysteria, etc. are due to a conflict between instinctive impulses and the forces by which they are controlled Mental health depends on the presence of a state of equilibrium between these conflicting tendencies.[22] Such a state is normally brought about by the social environment, and the education by means of which the individual is fitted for

the society in which he lives. The educative process, in its widest sense, is in fact one long means by which a balance is maintained between instinct and ideals, between raw human nature and the human nature which fits a man to live in harmony with his fellows. Now the conflict between instinct and social morality, in which every human being takes part at some time of his life, may be fought out in a variety of ways. Those who believe in the pleasure principle are apparently under the impression that all suppression of inborn tendencies by education is harmful. *It never occurs to them* that the repression of moral standards may be still more harmful. It is true that such repression may not produce the symptoms of psycho-neurosis, but it may produce other effects of a much more serious nature.[23] It is the supreme function of education to implant ideals of moral conduct and moral responsibility; so that when the time of conflict between sexual desire and moral conduct arrives the individual may choose the right. If the desires are satisfied and the moral standards repressed, by the operation of the law of habit subsequent relapses are made easier, and moral fibre is sapped. The view that harm necessarily comes from suppressing the inborn appetites is one which education must reject as inconsistent with morality. It would be a sad confession for teachers to make that in such conflicts the forces of morality have no power over the individual. The process of education is an unending course during which the innate tendencies and appetites should be opposed by ideals and social traditions.

The evidence on this matter from those who are in direct contact with boys and girls is very much to the point. Thus Dr F. A. Sibly,[24] who for over thirty years systematically gave sex guidance to boys from 9 to 19 years in school, and to several hundreds outside, summed up his experience thus: "The neuro-pathologist looks at pathological cases not from

an ethical but from a physiological standpoint, and, if he is a disciple of Freud, his chief aim is to put an end to the conflict between conscience and the libido The simplest way to do this is to persuade the patient that erotic satisfaction in some form or other is natural and blameless. We must beware how we attempt to oppose scientific theory merely because it menaces cherished ideals Men of large experience assert positively that most psycho-neuroses arise from sexual repression, and there are certainly cases in which the expert cannot hope for a *cure* of abnormal erotism, and it is quite clear that palliative measures are alone possible We have, however, a right to demand that measures appropriate to extreme cases shall not be recommended in milder cases.

" A far more serious menace to our cause comes from the vogue of Freudian views among general practitioners and the lay public. Whether the subliminal self is, as F. W. Myers believes, a region of our being in which unfolded powers of the soul are hidden, in which we are in touch telepathically with other beings, and into which we draw inspiration from the infinite and the etern , or whether as Freud represents, it is a moral cesspool in which the spiritual excreta of the soul collect from infancy, and from which they send their noxious vapours through our waking life and our dreams, research may presently shew Meanwhile, Freud's theory of a libido which *will* manifest itself in an open or disguised form, and his theory that evil repressed is not conquered but merely driven as a noxious influence into inaccessible parts of the mind is certainly giving, both in medical and lay circles, a pseudo-scientific authority to the idea that *ex*pression of the passions is less dangerous than *re*pression that strict chastity is not merely impossible but undesirable The harm such an idea can do is incalculable, because the sinner eagerly appropriates a theory which not merely excuses his sin, but presents it almost in the light of a duty. In justice to Freud one must

admit that this deduction from his theory is not warranted. He admits that evil influences may be transmuted into beneficent ones by the process which he calls sublimation Every intelligent spiritual worker knows that inhibition alone is valueless; that earnest direction of energy into the right channels is death to sin and life to virtue."

SEXUAL EDUCATION

It is largely owing to the influence of the psycho-analysts that the question of sexual guidance of the young has come into prominence This great debt, however, must not lead us to an uncritical acceptance of their dogmas. Thus, the Œdipus-complex, which is supposed to be a universal manifestation of infantile sexuality, presupposes a particular family constitution, namely the patriarchal form, and cannot therefore be a characteristic of other forms of society, for which reason it cannot be regarded as due to any inborn propensity. Again, this particular complex presupposes a strong natural tendency to experience sexual affection for near relatives, with whom one lives in close contact. But any stirring of the sexual impulse, such as the complex presupposes, needs a strong excitement, which does not occur amongst those who live together familiarly, for any such attraction is immediately dissipated when a stranger enters the family circle Family intercourse is not a suitable medium for the growth of sexual attraction, which requires a novel stimulus from outside. No doubt a young boy is attracted to his mother, the source of most of his joys, and when a new baby appears on the scene he may become jealous of the attention given to it. The normal boy, however, soon gets over it, and in turn becomes fond of his new playmate. If parental behaviour is injudicious, however, this may take a long time

and become difficult, but every family shews that it is the natural mode of reaction in family life

We previously pointed out the danger of attributing to children what is only true of adults or adolescents. The authority of Havelock Ellis [25] on questions of sex is supreme, and, in dealing with the question of masturbation, he states. " Here it is convenient and possibly legitimate to speak of sexuality, although it is not strictly correct, for we are concerned with an act which may, and often does, begin in a merely generalised and instinctive search for pleasurable sensations." If it is psychologically unjustifiable to call early masturbation sexual, we should be wary of attributing a sexual significance to more indirect acts. Parents and teachers, sooner or later, are confronted with the phenomenon of masturbation, and should know something of its manifestations It is very difficult to get correct information about its significance, owing to the fact that in the final decades of the last century this practice was regarded as a ' perversion ' when occurring in childhood, and was viewed with grave concern by the medical profession as likely to produce serious morbid conditions. Nowadays, we recognise that it is so widely spread in all countries that to call it abnormal is unwarranted Some, indeed, think that it is universal, but it is very hard to come by definite figures, and different investigators in different countries disagree as to the extent to which it is practised A recent American investigation which, however, was founded on the recollections of college students about their childhood, tended to shew that up to the age of eleven about half the girls, and up to the age of fourteen about half the boys had experience of this practice. Havelock Ellis, summing up the recent evidence, thinks that " it seems not so common in England, or even in France, as the American figures would lead us to anticipate ", and he is further of the opinion that its manifestations " are

natural; they are the inevitable result of the action of the sexual impulse when working in the absence of the object of sexual desire . . . and they are emphatically natural when they occur before adult age. It is natural also that they should occur in adult age when the sexual urge seem irresistible and when normal sexual approaches are undesired or undesirable, although, it must be added, that it is equally natural when, under such circumstances, they are inhibited or repressed by other considerations which may seem of a superior order."

In addition to masturbation other forms of autoerotism, or sexual emotion in the absence of the adequate stimulus of another person, are widely spread especially among adolescents, such as erotic dreams in sleep, erotic day dreams or phantasy, and so on These may occur quite spontaneously, or may be excited by directing the imagination, or by reading books, seeing films and the other excitements of the modern environment. In all such cases, it is a grave mistake to regard what may be largely involuntary or due to physiological causes as being in any sense sinful. With respect to masturbation, using this term, in a sense approved by Havelock Ellis, not only for sexual excitement by means of the hand, but for all forms of self-excitement brought on deliberately, it must be remembered that the danger lies in the feelings aroused in sensitive youths by the social condemnation of these practices. This social attitude produces unmerited self-reproach, and a brooding on the matter, which results in morbid introspection, leading to shame and remorse. When the self-excitement is excessively practised, harmful results to health may ensue, such as disordered circulation, headache, neuralgia and a tendency to nervous symptoms and irritability. "On the mental side the most frequent and the most characteristic result of persistent and excessive masturbation seems to be a morbid heightening of self-consciousness without any co-

ordinated heightening of self esteem. . The masturbator, if his practice is habitual, is often compelled to cultivate an artificial consciousness of self-esteem, and may shew a tendency to mental arrogance." Parents, teachers, or others who have to advise youth, will do well to bear in mind that it is the wisest course "to recognise the inevitableness of sexual and transmuted sexual manifestations under the perpetual restraints of civilised life, and, while avoiding any attitude of excessive indulgence or indifference, to avoid also any attitude of horror, for our horror not only leads to the facts being effectively veiled from our sight, but itself serves to manufacture artificially evils that may be greater"

It was stated above that many acts of children, which appear to adults to emanate from sexual feelings, have no such source, but arise from general curiosity or from the play impulse. Sexual guidance of children should begin in the home and should start early enough to avoid arousing any trace of emotion, and such guidance can best be given by a mother, who is free from inhibitions, and can speak of sexual matters quite naturally. In fact, at an early age it is only the mother who can deal with such matters. A child's desire to know where babies come from may be satisfied in some such way as that indicated on a previous page. If he does not learn the fact early from his parents he will usually derive the information in a distorted and vicious form from his schoolmates, and regard it as forbidden knowledge which must be concealed from elders As soon as curiosity is aroused it ought to be satisfied, but no more emphasis should be given to the information than would be offered when the child asked about any other natural fact of which he is curious. Information carried beyond the point demanded by the child's curiosity or understanding is to be deprecated. But the child's simple and natural questions should be answered simply and naturally, and his

attention should not be arrested by any suggestion of mystery. The longer the information is postponed the more difficult it becomes for parents to treat the matter in an unemotional manner, or to avoid suggesting to the child that he is approaching something mysterious which they would rather not speak about

There is one aspect of sex instruction which, though it does not directly concern those who are dealing with very young children, arises from what has been so far said For, we have maintained that children's questions should be answered, without suggesting that they are asking anything improper. This is sometimes interpreted to mean that the right attitude to adopt towards youth in sexual instruction is that all the functions of the body are on a par, and that they must all be explained on purely biological principles But this ignores the fact that there is a profound difference between sex and other physiological functions. Havelock Ellis, with his great scientific authority, has expressed this admirably "Sex and excretion will be dealt with as simply as anything else, and neither with the slightest sign of repulsion or disgust . for as the organs of sex and excretion are on the surface so closely adjoined any attitude of disgust towards one is likely to embrace the other. It is sometimes said that the right attitude to inculcate is that both sets of organs are neither disgusting nor 'sacred.' But, in one way or another, it has soon to be made clear that, while both sets of organs are natural and neither disgusting, there is an immense difference in their ultimate significance, and that what proceeds from sex may be so tragic for the individual and so fateful for the race that, even if we reject the word 'sacred' for sex, we must find some other word of equal poignancy."

It is now generally agreed that it is a great blunder to withhold information on sex until the age of puberty. The

knowledge should be gradually and imperceptibly woven into the fabric of childish and adolescent experience, so as to avoid any emotional shock due to lack of previous preparation. Moreover, the information given should be suitable to the age of the child, who is by no means interested in what interests adults What the young child is curious about, before the age of puberty, is the process of reproduction. The sexual act itself does not arouse his curiosity If he is a country child he sees this in the lower animals, but it has no emotional significance, and it only dawns on him at adolescence that it applies to human beings. We must beware of forcing sexual knowledge before it can be assimilated

In addition to the informal training given in the home, courses of biology in school spread over a period of years, including plant and animal life, and the human body with its various functions, ought to be given in all schools The function of reproduction should be included but not unduly stressed. As part of the course there should be instruction in personal hygiene, including especially the care of the body and modesty and reticence with regard to bodily functions Responsibility for the complete care of pets and other animals should be an integral part of the course. And the instruction should only be given by fully competent teachers with an objective habit of mind.

The removal of taboos on sexual matters, and the increase of biology teaching in schools, have led to the mistaken belief that the proper attitude towards sex is the purely scientific one, and that it should no more be regarded with reverence than any other scientific knowledge. Such an attitude is due to the swing of the pendulum from one extreme to the other, from complete suppression of all knowledge to complete refusal to regard sex as having any ideal significance. But undoubtedly sex is of a very different import from all other biological facts, and is not a matter only of physiological

significance I cannot refrain from yet a further quotation from Havelock Ellis, who has pointed out a distinction which biological instruction is apt to overlook. "It is along biological lines that we reach the modern conception of that aspect of sex which the ancients regarded as sacred, for we must not accept the notion of those foolish but well meaning people who wish to bring up children to regard sexuality as commonplace on the same level as nutrition and excretion Along the line of biology it is easy to understand that sex is much more than that, it is not merely the channel along which the race is maintained and built up, it is the foundation on which all dreams of the future world must be erected. There are other and more personal ends to which the sexual impulse may be directed, but there is always this solid central fact."

No doubt the dispersal of the aura of mystery which surrounds childbirth will, in the long run, create a healthier public sentiment More especially will it prevent youth from getting its knowledge from tainted sources But those who think that knowledge of the bare facts of sex is itself a guarantee of normal sexuality blind their eyes to the facts around them. Medical students as a class are neither more or less moral than the rest of the population; and village children and all the children of warmer climates have the relations of sex obviously presented. Does anybody really imagine that this knowledge is sufficient to secure a sounder morality? What is of essential importance is a moral environment due to the combined influence of the home, the school, and religious institutions; and mere knowledge of the facts of sex, given biologically, is not sufficient. Respect for morality is the guarantee of a moral life, and there are no substitutes for this. Whilst a knowledge of biology is a sound foundation on which to build, if such knowledge is dissociated from other aspects of life it is of little value for

guidance.[26] The knowledge must be integrated with the adolescent's training in ethics and the ideals of life; and the moral atmosphere, in which he is reared, is of deeper significance in sexual guidance than any training in biology. The following actual dialogue, in which the replies are given by the head master of a public school, may serve to emphasise this fundamental side of enlightenment.

"Is it your opinion that knowledge is not a safeguard any more than ignorance?—I believe in instruction in these matters, but I do not attach so much value to knowledge as some people do.

Do you advocate knowledge as of importance under proper circumstances?—As useful, of that I am quite certain.

You consider that everything depends immensely on the kind of way knowledge is given?—It depends immensely on the right kind of knowledge being given at just the time when it can be assimilated.

Do you think that the atmosphere is much more important than the amount of knowledge imparted?—You may give the definite instruction in a school where the atmosphere is wrong, and that instruction, however good, would be more likely to have ill effects than good. You have got to get the atmosphere ready before you do anything else. . .

Who creates the atmosphere?—I do not think I can answer that. But I think that the head master has to think more of creating atmosphere than of imparting knowledge.

But you think that the home ought to make the beginning? —There is no substitute for the home, either in religion or in any part of education." [27]

CHAPTER XI

ÆSTHETIC APPRECIATION

Æsthetic in Education—Psychological Theories of Beauty—Perceptive Attitudes (a) The Objective Attitude—(b) The Subjective or Physiological Attitude—(c) The Associative Attitude—(d) The Character Attitude—Psychical Distance—Appreciation of Music and Literature—Rhythm—Cultivation of Taste

ÆSTHETIC IN EDUCATION

NOTHING is more characteristic of modern reform in education than the recognition of the importance of æsthetic appreciation. A play of Shakespeare is no longer regarded as a cloak to cover exercises in formal grammar and philology, nor a sonnet simply as an excuse for a lesson on prosody. The best exponents of the teaching of English take the view that theirs is not a scientific study but an art, a means of arousing æsthetic appreciation and creative expression. Teachers of modern languages, using a more or less direct method, aim ultimately at making their pursuit a training in language as a fine art, and a cultivation of imaginative sympathy with foreign peoples. With these objects in view the writing of English verse and the acting of plays form an integral part of the work in schools where the ideal of a liberal education is kept in view

It has also become recognised that the masterpieces of music, painting and sculpture should take their place side by side with the best literature and drama in appealing to the

æsthetic feelings of the pupils. And an increasing number of teachers are convinced that it is desirable that a feeling for artistic crafts should be cultivated, in the reasonable hope that ugly homes and environments, generally, can best be eliminated by making them distasteful to the rising generation. It is widely held that technical knowledge and skill are necessary for the complete appreciation of art More will be said about this later in the chapter, but it is desirable here to call attention to an ambiguity in the meaning of the term appreciation.[1] The word is sometimes used for the capacity to estimate or judge the merit of a work of art in the light of previous knowledge and experience, the kind of ability which is exercised, let us say, by a professor of literature. On the other hand the meaning is sometimes confined to the capacity to derive satisfaction and enjoyment from art No doubt, it is not possible to keep apart the two significations, but it is the latter with which general education is more concerned The majority of pupils are quite incapable of acquiring sufficient technical skill in the arts to make instruction in such skill desirable for everyone. What general education should aim at is the cultivation of the capacity for enjoying what modern mechanical means of reproduction have made available for all. Craftsmanship stands on a different footing, for the number of those incapable of acquiring some form of skill in craft work is negligible, and whoever has practised a craft is a judge of sound craftsmanship.

The means for the cultivation of æsthetic appreciation are not lacking if the value of such training is approved. Some indeed, in the revolt against a utilitarian outlook in education, would search for æsthetic values in the most unexpected directions. "Mathematics, rightly viewed," says an eminent authority, "possesses not only truth, but supreme beauty—a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous

trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can shew." [2] Only a select few are capable of such appreciation, yet Mr Russell maintains that this aim is the sole justification for the universal tradition that decrees that every educated person should be acquainted with the elements of mathematics. Astronomy, indeed, bears in its train the whole gorgeous choir of heaven, and tradition for centuries demanded its study as one of the Seven Liberal Arts.[3] Some of the present overloaded curriculum of schools might well be sacrificed to make room for a pursuit so admirably calculated to stimulate appreciation of the universe as a whole, and entirely barren of any taint of practical appeal.

The nature of the material or subject-matter is, then, but a subsidiary consideration in dealing with our present topic, and we shall be concerned, in this chapter, mainly with the mental processes involved in æsthetic appreciation For artistic training is not confined to particular subjects, but depends on the attitude of mind adopted in dealing with its material All educational values, in fact, are relative to the mode of presentation, but it is in the field of æsthetic that the full force of this doctrine is felt

The objective nature and constitution of artistic products are special and distinct branches of æsthetic study outside the scope of psychological treatment, which is limited to the subjective point of view. According to Croce [4] the subjective essence of art is vision or intuition. The artist discovers a new point of view, and æsthetic appreciation consists in looking "through the chink which he has opened." A beautiful example of this is given by the consideration of Whistler's set of etchings of the Thames. Prior to 1860 nobody had realised that the mud flats and dun-coloured brick buildings of the riverside wharves had any artistic significance. Whistler fairly gloated over the silhouettes of the warehouses, the

lines of the barges, the riggings of the vessels, and by delineating the light and shade effects he created a new set of values which everybody now realises.

Appreciation rests on the intuition or recognition of such values, and is distinct from the contemplation of the world of scientific realities which involves reflective judgment. This distinction is well stated by Thomas Hardy who, in the preface to *Tess*, says that his novel is intended to be neither didactic nor aggressive, but that in the scenic parts it was meant to be representative merely, and for the rest charged with impressions rather than convictions. We may apply to art generally his dictum that "a novel is an impression, not an argument." But a bare impression, the mere contemplation of a crowd of images is not the essence of artistic intuition, which needs the touch of affective consciousness to give it organic unity. Even in representative art, such as painting or the drama, there is very extensive selection, rearrangement of the material, and above all invention, so as to secure certain effects. The true model is not primarily the external scene or action itself, but rather the attitude and emotion of the artist towards it. It is these which give the 'impression' its artistic value "One cannot imagine," says Sir Henry Hadow,[5] "a traveller threading his way through a Swiss valley with a Turner landscape in place of a map. Art is nature seen through a temperament, and by the quality of the temperament its true object is largely determined."

PSYCHOLOGICAL THEORIES OF BEAUTY

It was said above that the objective nature of a work of art is a technical study outside the scope of psychological treatment, which is concerned with the experiences by which

we apprehend the beautiful An important school of criticism has arisen which denies that a work of art has any objective quality of beauty independent of our reactions to it Dr I. A Richards, for example, maintains that the beauty of a work, which arouses our admiration, consists of the attitudes, propensities, emotions, etc which it evokes from us. Instead of saying that a work is beautiful, we ought to say that certain of its features provoke experiences in us which are valuable, because they satisfy our needs It is useless to search for any quality in a work of art different in kind from those which can be found in any object whatsoever. There is no objective beauty in the world of nature or art, but only our reverberations to the choir of heaven and the furniture of earth are beautiful.

So persuasive a case has been made out for this theory by Dr Richards [6] that the best way of treating it is to examine his views. These rest on the belief that the only things which are valuable are those which satisfy our propensities or appetencies " Anything is valuable which will satisfy an appetency without involving the frustration of some equal or *more important* appetency; in other words, the only reason which can be given for not satisfying a desire is that more important desires will thereby be thwarted." It is clear that this statement can only be of value if we have some psychological criterion of what is and what is not important. The test which is suggested is that " the importance of an impulse can be defined for our purposes as *the extent of the disturbances of other impulses in the individual's activities which the thwarting of the impulse involves.*" It is argued that the disturbance or thwarting will take place with the minimum of psychological loss if our propensities are organised, instead of being chaotic. For, if each appetite gains satisfaction when it arises, independent of the claims of others, man is on a level with the beasts. But systematisa-

tion involves subordination and the thwarting of some impulses by others. The subaltern, for example, cannot act on his own authority, he must await orders. We have, then, to find which amongst a number of possible organisations is the most valuable, and the criterion used is the same as before. "By the extent of the loss, the range of impulses thwarted or starved, and their degree of importance, the merit of systematisation is judged That organisation which is least wasteful of human possibilities is, in short, the best."

This sounds suspiciously like arguing in a circle; for importance is said to be determined by organisation and the merit of organisation is said to lie in safeguarding important impulses to action But the attractiveness of the theory rests not on the tightness of its logic, but on the question whether the essence of all values, not only the beautiful, but the good and the true as well, is to be found in organisation. Is it the case that "The problem of morality, the problem of how we are to obtain the greatest possible value from life becomes a problem of organisation . . . and is delivered from all non-psychological ideas. . . . Without system value vanishes, since in a state of chaos important and trivial impulses are alike frustrated"?

But organisation has not any value *per se*. The whole conception of systematisation or organisation is, in fact, dependent on the purpose served. Thus, the words in a dictionary are systematically arranged, and so they are in a play or poem. Of what value is a Chinese dictionary to anybody ignorant of Chinese? The concept of organisation is teleological through and through. There is no psychological method by which the merits of different organisations can be determined. Thus, when the pieces are set out, at the beginning of a game of chess, they can only rightly be said to be organised if we have a game in view. Without the thought of the game there is nothing corresponding to organisation, and

the pieces might be conceived as having been thrown down, at random, by one of those lucky chances which the calculus of probabilities assures us must occur if we go on long enough Suppose, however, the pieces are correctly arranged, and the game played by two masters of chess. As it proceeds, the arrangement of the pieces becomes more and more disorganised, except from the teleological point of view For, from the point of view of winning the game, the pieces are becoming more and more organised The purpose of chess playing entirely determines what shall be called organisation or disorganisation Nobody but a competent chess player can say whether a particular arrangement is systematic or chaotic, just as nobody but a Chinese scholar can say whether a set of Chinese characters is haphazard or systematic. In the light of these considerations, it is hard to suppose that a purely psychological theory of value can be given, which equates the fact of systematisation of our impulses with their value. All that psychology can do is to estimate the degree of organisation attained by any individual. As we shall see in the final chapter, this is done by means of mental tests. Such an evaluation is purely quantitative, and is made for the purpose of grading levels of intelligence. Political dictators in modern times all have a system, very well organised, and if this theory of value is sound, the lives of people under such a system ought to be supremely happy. I cannot imagine any method of determining the merit of these systems without reference to the ends they are supposed to accomplish, and the means by which they are attained.

A different psychological theory of beauty has been put forward by Professor S. Alexander [7] in which, however, the part played by the work of art itself is more in evidence. He, too, believes that beauty cannot be a quality which we apprehend, since there is no organ whose function it is to perceive beauty, as we apprehend shape, for instance, by

sight or touch. Beauty must be sought in some relation between the mind and the object, whereby the latter satisfies some propensity of the former. Not, however, some mysterious propensity whose sole function it is to apprehend beauty, since there is nothing beautiful apart from its apprehension by some mind. The judgment that a work of art is beautiful is, of course, secondary to the apprehension or contemplation of it. According to Professor Alexander the distinguishing feature of such a judgment of value is that the work is apprehended for its own sake. "It is not merely contemplated as it presents itself in the course of practical or even theoretical life, but for itself, and its value is therefore called intrinsic."

We may, perhaps, find it easier to understand how we come to perform such a purely non-utilitarian act as contemplating anything for itself alone, if we consider the uses of language In its origin language had the entirely practical purposes of communicating to others our emotional states or else to indicate objects or ideas Objects could also be detained in the mind, or referred to in their absence, by the use of speech alone. All these purposes are severely utilitarian; and it is a far cry, from such uses of speech, to regarding language itself as an object of contemplation, to be used for no other purpose than the joy it gives by its form. The first man who discovered that you could play with words and derive satisfaction from the process was the first poet He was, of course, constructing something of value out of the material at hand, namely words. All art is construction, after this manner, out of material which, at first sight, looks very unpromising for the purpose, such as wood, stone, pigments, tones, etc So that, whatever else a work of art involves, it embodies some use of the constructive impulse Just as with language, so in all other cases, the constructive impulse, at the outset, subserves only practical ends—the

making of tools, houses, etc. The craftsman, however, becomes an artist in so far as he treats his materials for their charm instead of for utilitarian purposes.

The charm of the artistic product has been added to the material from the artist's own personality. There is nothing in stone, or pigments, or even in words, which has any suggestion of an æsthetic quality until the artist mixes himself with his material. In this sense there is obvious truth in the theory that beauty is not a quality of objects but of our relation to them. "It is this admixture to the given material of form imported from the artist himself, and not belonging to the material itself, which detaches the materials from mere natural use in practice and makes them objects treated for their own sakes." In this process, not only is significance added to the materials through the form they receive from the artist's creation, but the material itself, the stone, the pigments, etc., become transfigured When the material used is language the words are not only enchanting but enchanted, for they acquire a significance they do not, of themselves, possess, owing to the intermixture with the poet's personality. The poet A. E. Housman [8] says "In these six simple words of Milton

'Nymphs and shepherds, dance no more' .

what is it that can draw tears, as I know it can, to the eyes of more readers than one ? What in the world is there to cry about ? Why have the mere words the physical effect of pathos when the sense of the passage is blithe and gay ? I can only say because they are poetry."

If it is correct that, for real appreciation, the reader or listener must in some fashion go through constructive processes similar to those of the artist ; then beauty may be regarded as whatever satisfies the constructive impulse when it becomes contemplative, instead of subserving practical

uses. But every artistic product, in greater or less degree, involves originality or creativeness If it did not, we could all, by taking thought, become artists. We may apply to art in general what Goethe [9] is reported to have said about novels: "A novel is a subjective epopee wherein the author begs leave to treat the world after his own fashion the question therefore, is, Has he a fashion? The rest will attend to itself." Few artists are particularly original in the choice of a theme, but nevertheless originality is shewn in the angle of vision and in the manner of accommodating the material to the presentation of that angle. He may produce what has been often produced before, but if he has his own point of view he is a great artist. For this reason, it seems to me, that the attempt to propound a purely psychological theory of beauty can never be successful, since originality defies analysis.

The contribution of the artist's mind to the work of art is the formal side of it, as contrasted with the material. Such form is not merely the arrangement of the material in space or time, but "the system of relations in which the parts of the material are unified; the form of a picture is dynamic as much as that of music, the form of a poem is not merely an arrangement of sounds, not even of sounds with their meanings, but the interplay of them." In some kinds of art the formal aspect completely swamps the material, as in pure music which has no reference to anything outside the tones themselves But even in those arts which are by their nature representative, such as painting and sculpture, the formal aspect, especially in modern art, is predominant. What the modern painter does, for example, is first of all to reveal what he means in paint and only secondarily what he desires to represent He may, indeed, have very little interest in the latter aspect. At all events, that is what some artists declare they are aiming at; and there are some

lucky people, not themselves artists, who feel they can appreciate such formal painting. This standpoint is amusingly illustrated in a conversation which a friend of Whistler's has reported. "I told him how much I admired his portrait of his mother. He said that to him it had a special interest as he was fond of her, but to others its beauty could be just as well seen if they looked at it upside down"

In representative art the things represented are transformed in the artist's vision, so as to correspond to the material form which he gives them. It is this transformation, or enchantment, which reveals the creative spirit The resulting product gives us a feeling of delight due, no doubt, to the harmonious response of our attitudes and emotions. And in this sense Richards's theory of organisation finds some justification. But it is not the organisation which creates the beauty, for the creation must have been accomplished before the organised mind can find satisfaction in contemplating it. We may conclude that, for æsthetic appreciation, it is necessary that the constructive impulse, divorced from practical issues, should be satisfied within a well-organised mind, whose other propensities receive due satisfaction owing to the organisation. But whilst this psychological system is necessary, it is not sufficient, for what sets it going must be beautiful in order that æsthetic satisfaction may ensue from its activity.

PERCEPTIVE ATTITUDES

The prerequisite of all appreciation is an intuition or perception of the admired object, leading to the contemplative attitude. But it would be a mistake to regard such artistic perception as an ultimate unanalysable faculty. Psychologists have long since abandoned explanation by means of faculties and no longer refer, for example, to a faculty of imagination, but

analyse this partly into the various kinds of imagery involved, such as pictorial, auditory, etc., and partly into affective and conative constituents, but chiefly, as we saw in an earlier chapter, into a certain originality of attitude. It is fatally easy to perpetuate the blunder and to talk of artistic appreciation as though it were some primordial power, unique and therefore indefinable. We can avoid the error by shewing what different attitudes are involved in such appreciation.

The best introduction to the investigation of these attitudes is to be found in the psychological significance of certain grammatical forms which are common to all languages. Thus, the study of metaphors bears witness to an attitude towards objects which is illuminating from the point of view of art appreciation. Metaphors arise from the perception of a similarity between objects or ideas which is so fundamental that one is thereafter identified with the other The great majority of the words in a language, except those naming physical objects, are metaphors or the débris of metaphors, but the identification is usually so complete that all sense of the metaphor is lost.[10] What is crooked has become the symbol of all that is perverse (pravus) and motives to conduct which serve to hide one's real motives are borders to conceal the faults of the stuff (prætextum). So too the valuation of money lends its name to all kinds of estimation (æstimare). And astrology with its belief in a fluid which flowed from (influere) the stars and acted on men, provided the word for all imperceptible action But these metaphors are dead, for who thinks of these words now as metaphors except the philologist? The identity is so complete that the metaphorical sense is unconscious In the last example (influence) the metaphor was still alive in the time of Milton who wrote in " L'Allegro " :

> " With scores of ladies, whose bright eyes
> Rain influence."

The process still continues, for as soon as a new metaphor is introduced and its aptness discerned, it becomes common property, passes into current discourse, and its metaphorical significance vanishes. Nor is it restricted to one language, for the most striking metaphors enter into different tongues, as may be seen by a comparison of the words *discover* and *entdecken*, *comprehend* and *begreifen*

In some cases the process has not carried language to this point, so that it is easier to discover the metaphorical sense of the expression. Instances of this occur when an epithet suitable to one domain of sense or feeling is transferred to another. We talk of a *deep tone*, a *loud colour*, *black care*, *bitter grief*, etc., and the aptness of the expressions is evident to all at first sight. Again, we have cases in which the metaphor is less completely assimilated, so that its borrowed sense is still evident as in Milton's "motes that *people* the sunbeam," and Browning's "The air broke into a *mist* of bells," or when we speak of petty annoyances as *pin-pricks*. Whether a metaphor is living or dead, in every case its distinguishing psychological function is the attribution of some quality or action peculiar to one object or idea to some other, so as to lend it a character which is thenceforth regarded as its own property.

The most illuminating instances of transference are those in which our own feeling, emotion or mood is read into inanimate things so as to give them human character. This tendency has received the technical name of empathy,[11] 'feeling into,' coined to correspond with the word sympathy 'feeling with.' Examples abound in poetic diction: thus the psalmist sings:

> "Let the sea roar, and the fulness thereof;
> The world, and they that dwell therein;
> Let the floods clap their hands;
> Let the hills sing for joy together."

And Shakespeare.

> "The rude sea's enraged and foamy mouth."

And Milton

> "The stars with deep amaze
> Stand fixed in steadfast gaze."

The whole realm of nature is viewed in this way by those poets whose perceptions are strongly tinged with their own emotion. Wordsworth regarded this as the distinguishing mark of a poet who is "a man pleased with his own passions and volitions, and who rejoices more than other men in the spirit of life that is in him delighting to contemplate similar volitions and passions as manifested in the goings-on of the Universe." [12] The following lines of Coleridge though suitable for descriptive verse may, as he points out, by a slight alteration of rhythm be regarded as prose

> "Behold yon row of pines, that shorn and bow'd
> Bend from the sea-blast, seen at twilight eve."

Yet the same image 'will rise into a semblance of poetry if thus conveyed'

> "Yon row of bleak and visionary pines,
> By twilight-glimpse discerned, mark! how they flee
> From the fierce sea-blast, all their tresses wild
> Streaming before them."

Though this metrical experiment is only a 'semblance of poetry' yet it serves to illustrate the magical transforming effect of empathy.[13] It is important to realise that whilst the origin of these feelings is in ourselves, and they are read into nature by a translation from our own consciousness, it is nevertheless erroneous to suppose that the process is a deliberate one. Rather, such emotions and volitions, as Wordsworth says, are directly discerned in the objects as soon as they are perceived, and they are seen at once as endowed with a life of feeling similar to our own. How little conscious purpose has to do with empathy may be inferred from the

fact that it is coeval with humanity, being the basis of universal primitive animism. Neither can time wither it nor custom stale its freshness, since the capacity to perceive in this manner is the supreme form of æsthetic intuition.

Approaching the matter from an entirely different standpoint, Dr C. G. Jung has observed that in some cases of mental disease there is an exaggerated intensity of feeling and in others extreme apathy In normal persons, too, we may trace the existence of similar psychological types characterised by a predominance of feeling or of abstract thought respectively.[14] The libido or *élan vital* urges the individual to respond to the world in one or other of these ways. "The one who feels his way transfers himself to some extent to the object; whilst the other withdraws himself from the object to some extent, or pauses before it and reflects about it. The first is called the *extraverted* type, because in the main he goes outside himself to the object, the latter is called the *introverted* type, because in a major degree he turns away from the object, withdrawing into himself and thinking about it." In extreme cases the one limits himself to observation and reflection, the other to feeling. The latter finds æsthetic satisfaction in empathy, whilst the former, as in the case of Mr Russell previously quoted, discovers beauty in the rigidity of abstract law Empathy is the result of warmth of passion which is carried over into the object in order to assimilate it or penetrate it with emotional values Abstraction, on the other hand, despoils the object, even when it is organic, of living qualities and grasps it by purely intellectual thought, crystallised and fixed into the rigid forms of universal law. In fine, the introvert abstracts from the object and deals with it by concepts, concentrating upon the inner world of thought, whilst the extravert goes forthwith to the object and feels himself into it.

The experimental study of æsthetic appreciation has

established the existence of four different modes of perception. Before an object can be appreciated, whatever its nature, its meaning must be grasped, and it is clear that for experimental purposes a work of art, such as a picture or a musical composition, is far too complex. Experimental work has accordingly been confined, in the first place, to the simplest material, such as colours or tones, but the results, as far as music is concerned, have been verified by dealing with finished compositions.[15] By presenting single colours or simple colour combinations to different persons, and recording their comments, Mr E. Bullough has shewn that different people range themselves under one or other of four non-exclusive classes. These represent differences in the attitude of the subjects towards the colours, in that they perceive them and other æsthetic objects from different aspects. As with all other mental differences rigid divisions between the types or classes do not exist, since the majority of individuals belong to mixed types, but shew a tendency to a more consistent adherence to one of them. Such differences of adaptation to an object form the foundation on which all æsthetic experiences are constructed. Ultimately the difference of adaptation rests on the temperament and personality of the individual and, to a lesser extent, on his momentary mood. Thus the appreciation of æsthetic values touches the very core of human individuality The types of perception, or differences of attitude, distinguished by Mr E. Bullough are here set forth. It is to be noted that the attitudes are adopted completely unconsciously, i.e. they are not deliberate, but automatic.

(a) *The Objective Attitude*

Persons who adopt this attitude primarily emphasise the purity of a colour or a tone, its brightness, saturation, poorness, etc , and they have a tendency to compare it with some standard of purity Their appreciation, in so far as it can be

said to exist, for their attitude is almost extra-æsthetic, is intellectual rather than emotional. They are the most critical but the least appreciative, and adopt conformity with some standard as their reason for æsthetic valuation. The critical attitude seems to interfere with the free flow of imagination. When those who adopt this attitude read a sonnet, for example, they subconsciously ask themselves what particular model is employed and whether the form is correct

(b) *The Subjective or Physiological Attitude*

Persons of this class refer to the stimulating, soothing, exciting or temperature aspects of the object. A colour or tone produces organic and affective changes in them, and so they call it warm, cold, depressing, exhilarating, and so forth. For the same reason they sometimes complain that the colour is glaring or trying to the eyes, or that a tone is piercing or makes them shudder, or appealing and makes them sad It may be thought that these effects are due to suggestion or association, but this is negatived by the observation that whilst red, yellow and orange are described as warm colours, red is always the warmest, whereas if the effect were due to association with the sun we should expect yellow or orange to be the warmest. Moreover, those who take the associative attitude are not necessarily sensitive to these effects.

The subjective attitude is marked by very pronounced physiological responses. Thus a person of my acquaintance who has a fine taste in literature and is an accomplished musician tells me that such responses occur when he hears a superb piece of violin playing to which he is fully attuned. This induces gooseflesh and an inability to perform any normal act. The parts of the body mainly affected are the bottom of the spine and the eyes, which pour out tears, not definable as tears of joy, sorrow or anything else. Also there is a desire to grip something hard, which is a sign of deep emotion.

The general feeling is that the beauty is 'more than earthly' and this other worldliness is what produces the marked bodily resonance.

Sir Henry Hadow [16] has called attention to similar physiological effects "Music appears to be more dependent than any other art on the physical condition of the nervous system. To a majority of people the actual sound, apart from questions of context or implication is deeply soothing, from the days of Saul onwards its aid has been summoned and utilised as a curative agency. To many its effects of speech and rhythm may be intensely stimulating; in 1848 the Hungarian government was obliged to prohibit the Racoczy march because its melody was dangerously exciting"

These effects are, by no means, peculiar to music but may be produced by anything of æsthetic significance In fact it has been maintained, without paradox, by the poet A. E Housman that such responses are indubitable criteria of æsthetic value On being asked to define poetry he replied that he could no more do this than a terrier could define a rat, but "we both recognised the object by the symptoms which it provokes in us. One of these symptoms was described in connection with another object by Eliphaz the Temanite 'a spirit passed before my face, the hair of my flesh stood up' Experience has taught me, when I am shaving of a morning, to keep watch over my thoughts, because, if a line of poetry strays into my memory, my skin bristles so that the razor ceases to act. This particular symptom is accompanied by a shiver down the spine; there is another which consists in a constriction of the throat and a precipitation of water to the eyes; and there is a third which I can only describe by borrowing a phrase from one of Keats's last letters, where he says, speaking of Fanny Browne, 'everything that reminds me of her goes through me like a spear.' The seat of this sensation is the pit of the stomach." [17]

(c) *The Associative Attitude*

This variety is common enough, being the type which in the sphere of language creates similes. Such persons, on being faced with an æsthetic object, promptly and unconsciously pass to associated things A colour suggests a sunset, a landscape, a storm at sea, and so on ; whilst a tone may recall a symphony, a church service, the face of an absent friend, and a host of other associations immediate or remote. It may happen that the associations are symbolic, a musical note suggesting looking through a misty veil, or a narrow streak of light streaming in a particular fashion , and this kind of association shades off into synæsthesia or coloured hearing, where every tone has its distinctive tint. Just as with some people every vowel is coloured. The poet Heine had a similar faculty in a peculiarly marked degree. He speaks of the "gift of seeing with every note which I hear its corresponding figure of sound · and so it came that Paganini, with every stroke of his bow, brought visible forms and facts before my eyes , that he told me in a musical picture-writing all kinds of startling stories ; that he juggled before me at the same time a show of coloured Chinese shadows." [18] Finally there is

(d) *The Character Attitude*

Subjects who adopt this attitude tend to personify the æsthetic objects They perceive in them characteristics which in the case of a human being would be called his mood, temperament or character. A colour or tone may be described by them as insipid, stubborn, jovial, energetic, gentle, solemn, grotesque, fidgety, etc. Persons belonging to this class, on the whole, agree remarkably well in the characters they assign to the same colour or tone , thus shewing that the phenomenon is not due to association. They agree, for instance, in perceiving a temperamental contrast between red and blue, and colours

containing these tints. Red is described as sympathetic, affectionate, and its character is open and frank, whereas blue is reserved, distant and unsympathetic. The origin of this type is to be sought in empathy, a projection into the object of affective characteristics which are essentially human. But it must not be supposed that the projection is a conscious process, or that the subject recognises that the characters are transferred No sooner is the object perceived than the character aspect is evident and *there*. The case is exactly analogous to the perception of distance by vision, which since Berkeley's day is regarded as having its origin in muscular and tactile sensations, nevertheless no sooner do we open our eyes than we *see* the distance of any object in our neighbourhood. On occasions, it may happen that an object is perceived as solemn or melancholy at a time when the percipient himself is jovial and gay, when it would be palpably absurd to talk of consciously projecting his own mood. As previously observed, the tendency to regard æsthetic objects from their character aspect is the same as that which produced animism amongst the primitives, and is the distinguishing mark of poetic insight To ascribe such a faculty to a conscious translation of feelings is totally to miss its significance. Its essential feature is a mystical discernment of identity with oneself in the object, which gives rise to a peculiar emotional response, leading to sympathetic understanding. Artists who belong to this class have no abstract preference for any particular 'subjects'; all may be beautiful in their eyes. Some indeed do not hesitate to assert that the character aspect alone is what art should seek to display. "*Character* is the essential truth of every natural spectacle whatever, beautiful or ugly," said Rodin; [19] "it is the soul, the feeling, the idea which is expressed in the traits of a face, the gestures and actions of a human being, the tints of a sky, the line of a horizon. Now, for the great artist, everything in nature

exhibits some character for the uncompromising sincerity of his observation penetrates into the hidden sense of everything."

Whilst the objective type is determined, as was said, by conformity to some standard, in accepting or rejecting a work of art, the character type are guided in their judgments by sympathetic resonance with it, and are therefore likely to be the least critical This must not be interpreted to mean that the study of the highest standards of art can be neglected in æsthetic education, since the contemplation and reverence of these is the surest way of stimulating the finer perceptions. For the great artists in striving after ideals have revealed the character aspect to less discerning minds. Doubtless this is what Rodin intended in his testament to young sculptors when he admonished them to study diligently the great masterpieces " Love the masters who preceded you with devotion. Bow before Phidias and Michael Angelo Admire the serenity of the one and the fierce anguish of the other. Admiration is a generous wine for noble souls." [20] As sincere admiration can only come as the result of perfect understanding and familiarity, those teachers are justified who strive to inculcate ✓ at an early age the great masterpieces of literature, so that the pupils practically know them by heart and have them as a permanent part of their mental structure.

The importance of tradition in literature has been emphasised by T. S. Eliot,[21] who points out the danger of ignoring it. The existence of a right tradition he says, " simply by its influence upon the environment in which the poet develops, will tend to restrict eccentricity to manageable limits : but it is not even by the lack of this restraining influence that the absence of tradition is most deplorable. What is disastrous is that the writer should deliberately give rein to his ' individuality,' that he should even cultivate his difference from others ; and that his readers should cherish the author

of genius, not in spite of his deviations from the inherited wisdom of the race, but because of them"

PSYCHICAL DISTANCE

It is said that the best descriptions of mountain scenery have been written by those who are not mountaineers. Certainly support is lent to this view when we consider that Ruskin, who has given some of the best descriptions of the Alps in literature, regarded mountaineering with haughty disdain, and Kipling, in *Kim*, has invested his descriptions of the Himalayas with a feeling for the infinite Doubtless, the recollection of the physical effort and the dangers involved in climbing great heights may be a bar to the detached view necessary for æsthetic contemplation; for an indispensable condition for all appreciation is such cutting loose or release from the practical standpoint. Thus a thunderstorm on a summer night appears beautiful if we can ignore its possible destructiveness, and contemplate simply the vivid effects on the landscape lit up by momentary violet flashes of sheet-lightning. By eliminating the practical attitude and adopting a completely disinterested standpoint the experience is brought to the æsthetic focus and given what has been called 'psychical distance.' [22] Such an attitude is closely akin to the attitude of play, and may develop out of it.

The remarkable success of the Play Way [23] method of teaching literature shews the importance of this attitude in developing appreciation. It has been conclusively shewn that for boys under ten years of age the dramatising of traditional ballads, and for those over ten the acting of Shakespeare's plays, with all the joyous freedom of play, is the most efficient means of securing æsthetic appreciation. Schoolboys have a special power of projecting and imagining themselves as

characters seen and heard,[24] and this faculty, rendered definite by acting, enables them to get that insight, vision or intuition into character which is the essence of dramatic art. Moreover the elimination of the school atmosphere obtained by having the plays performed in a specially adapted room helps to secure the 'distance' experience As in other arts, a true feeling for drama best arises out of the trial practice of the art. If the objection is made that school is meant for work, it may be pointed out that by the Play Way boys under fifteen years of age have been led to understand and appreciate Shakespearean tragedy in a manner incredible to pedagogues who do not realise that a play is meant to be acted Although the attitude of detachment from practical considerations is essential, it must not be supposed that æsthetic appreciation consists in taking an impersonal view. Rather, it is a peculiar kind of personal relationship with the object, often highly emotionally coloured, but the personal character of the relation has been 'filtered' or cleared of its practical concrete nature. Æsthetic intuition is diametrically opposed to any sort of practical appeal. In drama, for example, the characters "appeal to us like persons of normal experience, except that that side of their appeal, which would usually affect us in a directly personal manner, is held in abeyance." Such detachment, however, must not be too great or the artistic effect is apt to be lost. Both in appreciation and in artistic production what is required is "the utmost decrease of distance without its disappearance." This concept of 'distance', sometimes described as the 'frame' effect, serves to make clear the distinction between the agreeable and the beautiful in art. The agreeable is a pleasure which has not been cut loose or distanced from our practical interests, its centre of gravity lies in the self, whereas the centre of gravity of an æsthetic experience lies in the object. For this reason the consideration of pleasure is as foreign to the æsthetic

appreciation of a work of art as the question of its money value, since 'distance' raises the work of art out of the realm of practical systems and ends. In the attempt to drive home the importance of this conception of art to his generation, Whistler, with his usual directness and emphasis, insisted that art should stand alone and appeal solely to the eye or ear. It must not be confounded, said he,[25] "with emotions entirely foreign to it, as devotion, pity, love, patriotism and the like. All of these have no kind of concern with it, and that is why I insist on calling my works 'arrangements' and 'harmonies'"

We must make due allowance for the over-exaggeration of missionary zeal in considering this standpoint of the autonomy of art, or the theory of 'art for art's sake.' But a serious difficulty arises when the question of the relation of art to morality is considered. It would be vicious to maintain that morals, like emotions, can be distanced, yet there have not been wanting those who believe that art is outside the realm of morality. Nothing human can be, in any ultimate sense, outside this realm, yet the view is one which has frequently been found to appeal to immature minds; and modern teachers of literature, anxious above all things to stimulate the imagination and arouse appreciation, sometimes fall into the same error.[26] But there can be no holidays from morality even in imagination In literature the blunder arises from a failure to distinguish between two distinct things, namely the moral point of view which is an organic part of the artistic conception, and a morality imposed upon it from without "It is clearly a mistake," says J. Drinkwater, "to suppose that moral judgment did not come within Shakespeare's scheme. Every one of his plays from the dark and terrible pity of *Lear* to the light and gracious revelry of *Twelfth Night* is charged with moral judgment, but it is a judgment that is strictly complementary to the action of the characters within the play, and as organically a concern of the poet's creative function in the play as

are the characters and actions themselves. In other words, the moral judgment becomes inevitably a part of life itself, and is an altogether profounder thing than a merely abstract moral point of view." [27] Drinkwater rightly maintains that in respect of making morality an integral part of poetic creation instead of fitting the latter into a prearranged scheme the Shakespearean era was definitely superior to the Victorian; and the reaction against the later conception has led some modern poets and teachers to the absurd misconception "that supposes it to be outside poetry's function to have any moral purpose whatever." He shews that it is the chief glory of Elizabethan poetry to be intensely concerned with moral consequences, which flow inevitably from the poet's conception of life. And though Milton, in constructive grandeur and poetic imagination, is on the same level as Shakespeare yet in seeking to "justify the ways of God to men," he would have risked the integrity of his art but for the supreme intensity of his moral conviction. So far from dramatic art (and the same is true of all literature dealing with humanity) being outside the realm of moral judgment it only justifies itself when its moral character develops inevitably as it grows, being an essential feature of its creation.

Modern critics, e.g. Dr I. A. Richards,[28] go farther than this and maintain that there is no essential difference between the experiences dealt with in literature and those of the everyday world. The theory of the autonomy of art, they say, is due to a mistaken view of the nature of experience. Just as Whistler and Pater insisted that painting was concerned solely with a world of colours, so it has been believed that poetry dwells in a sphere of its own severed from the mundane world of values. Dr Richards points out that this is only true of such works of fancy as Coleridge's *Christabel* and the like, in which an imaginary world has been deliberately invented for the poetry to inhabit. In such a world the

intrusion of values foreign to it would destroy the illusion and charm of the experience. But in other poetry, such as the *psalms*, the poetical value is directly bound up with the ultimate aims of human life. The worth of this and similar kinds of literature is derived from the ends which it sustains, including everything of social worth in human experience. "The world of poetry has in no sense any different reality from the rest of the world and it has no special laws and no other worldly peculiarities. It is made up of experiences of exactly the same kinds as those that come to us in other ways. . . It is more highly and delicately organised than ordinary experiences of the street or the hillside, it is fragile" More especially must it be emphasised that there are not two sorts of morality, one suitable for poetic experiences and the other for the everyday world, but that all experiences are organised into one universe of experience in which each part reacts on the whole. Making due allowance for the 'distance' effect this standpoint seems to me entirely sound, and it is desirable to emphasise it in an age when traditional morality is questioned

APPRECIATION OF MUSIC AND LITERATURE

The existence of the various perceptive attitudes was demonstrated originally for the material of the arts. It is interesting to learn that Dr C. S. Myers found that, in listening to music as one would in a concert hall, the same attitudes were displayed.[29] The subjects who took part, both in the experiments on tones and in listening to the more complex material of musical compositions (played on a gramophone), judged the material from the same aspect in either case. With the more complex as with the simpler material hardly any person was of an absolutely pure type, and moreover

different kinds of music evoked different attitudes in the same person; so that even for the same individual there are different ways in which music may be appreciated.

The impossibility of complete separation of the types is well shewn by the observation of technically trained musicians. These were found to adopt the objective attitude which, it will be remembered, is that taken by unmusical persons with regard to tones. But, for the musicians, this aspect is artificial, and is evident only because the others have been suppressed, as is shewn by the observation that, when taken off their guard, the character aspect emerges; having been there all the time but inhibited by their critical attitude in the experiments.

In describing 'empathy' we saw that some poets enjoyed, as it were, a mystic insight into nature's moods, and it is probably the case that all appreciation of beauty has in it some touch of mystical character. Despite this, there is no doubt that appreciation can only be developed by suitable training. Many schools in England now include, in their curriculum, lessons on musical appreciation, and by help of the gramophone and wireless installations all may do so in the absence of an executant. Short preliminary discourses on the distinctive work of some composer are given and subsequently illustrated by the music. A word or two prior to each composition on its structure, the use of different instruments, the way the effects are obtained, etc. has been found sufficient to lead boys to take an intelligent and cultivated interest in the best music. Such lessons given once or twice a week and spread out over three or four years are sufficient to introduce the pupils to all the best music and lead them to prefer and enjoy it. For, in the realm of art, the good tends to eliminate the bad. When the pupils are encouraged to perform the music themselves the results in the hands of an enthusiastic teacher are most striking, shewing that the ability

to appreciate the finest music is very widely if not universally spread. Mr E. T. Smith, working in one of the worst districts of London, in an elementary school, with no previous tradition either in the home or the school, has demonstrated that children under fourteen years are capable of appreciating and even performing grand opera.[30] His course lasts six years, and the time devoted to music is not greater than that in other schools. It begins with folk dances and song, and proceeds according to the historical development of music, the technique of oratorios and operas and the values of the various instruments being carefully studied in detail "An incident in the experiment was the production by the children of a grand opera, viz. Gounod's 'Faust,' the recitatives practically without 'cuts' and the choruses in four and occasionally five parts." The children also performed "The Magic Flute" and read Wagner at sight with great enjoyment. It should be added that the course involves an elaborate study of technique, and a detailed explanation of the varieties of musical composition and the points to be looked for, since Mr Smith believes "that the appeal of the best music is intellectual rather than physical . . it must be understood by the head as well as the heart; and the knowledge necessary for such an appreciation must be taught" There is no doubt that his results justify his method, and the genuineness of the appreciation is evidenced by the fact that several parents in the district replaced their jazz gramophone records by records of first-rate music, owing to the pressure of their children Good art universally tends to drive out bad.

There is no reason why the composition of simple melodies should not form a part of the ordinary school programme in music, and there is no doubt whatever that, for some pupils, such composition is a first-rate means of stimulating the understanding and appreciation of the best music. If it be objected that the results of such attempts at composition are

bound to be worthless, the reply may be made that pupils are universally expected to compose in language and that this is regarded as essential to understanding and appreciation Moreover, children in Welsh schools are taught to compose in music and the results justify the attempt. The outline of the procedure may be learnt by consulting a pamphlet by Sir Walford Davies on melody-making.[31] The basis of the method is the explanation of the structure of melodies beginning with scales, chords, rhythms, etc., and proceeding by the analysis of adventure (the first thought) balance and cadence, all illustrated by examples from the great composers. Experience has shewn that children under fourteen are capable, after such a course, of composing simple and enjoyable melodies. As was said previously, the best introduction to the enjoyment of the fine arts is the trial practice of them.

In the realm of literary appreciation some excellent work has been performed both with primary and secondary school children. The work of Mr G. Lamborn in a primary school in Oxford, and that of Mr Caldwell Cook in the Perse School, Cambridge, are of first importance in this connection, and have given a new turn to the teaching of English Their books, named in the notes at the end of this volume, should be consulted for the methods they employ in stimulating a taste for literature It needs to be stated, since it is apt to be overlooked, that both these teachers by no means neglect the more scholarly and formal parts of language study, but their astonishing results are due to the fact that the emphasis is not placed on them ; they are but a means to the aim of cultivating appreciation and creative expression. Mr Lamborn, indeed, believes that as far as poetry is concerned there is a mystic insight necessary to perceive the beauty, which cannot be intellectually explained. And although he thinks that explanations are only permissible when they increase enjoyment, he by no means neglects the thorough

study of stanza forms, metre and rhyme. He has good exercises for developing the power of word description, the pupils being set to describe some scene, and the result is judged by the ability of the class to recognise the exact place described. The use and abuse of simile and metaphor are also taught by employing them, and the children are encouraged to take similes and compress them into metaphors Other figures of speech are learnt by studying the effects produced by them in good poetry, and by original exercises founded on these Similarly, rhyme arrangements, and stanza forms, together with the whole architecture of verse are carefully studied, and writing in verse forms make these a delight to the children Exercises in verse, properly conducted, compel boys to discriminate nicer shades of meaning, to weigh values and, in fact, to get a 'feeling' for correct language Rhythm is emphasised and practised in its varieties, and the boys are made to feel the distinction between rhyme and assonance As the results of the original exercises in verse and prose have now been published, it is unnecessary to do more than refer to them here. But it is important to note that these teachers believe "that poetry, its rhythm, its music, its imagery, its figures of speech, are instinctive in children, that they have a natural appetite for them, and an intuitive gift of using them. . . . I suggest that children [under fourteen] can express themselves better in verse than in prose." [32] The conclusion of the whole matter is that the thorough study of form, in so far as it is undertaken for the purpose of assisting creative expression in verse, is the most effective means of securing appreciative enjoyment of poetry. And the method is the Play Way.

No doubt in the pre-adolescent stage of a pupil's career the imagery of poetry is an essential factor in securing appreciation. But for later stages its importance is greatly overrated.[33] It is only in a limited kind of poetry, where the

meaning is largely embodied in the imagery, that the arousal of images in the mind is an aid in appreciation. Just as with music, however, such images must fuse completely with the poet's meanings, and this fusion must be unconscious if appreciation is to be aroused If the images are isolated and refuse to blend they may be a positive hindrance to enjoyment. Any deliberate attempt to awaken imagery, apart from that which develops spontaneously, as the poetry is read or heard, as is sometimes done in class teaching by emphasising the images, is apt to defeat its own purposes and to interfere with appreciation There is no reason to suppose that, for older pupils at all events, poetry whose meaning is mainly dependent on imagery is easier or more enjoyable Anything, in short, which obstructs the easy flow of a literary work militates against the æsthetic attitude. Not only is the unified emotion destroyed, but, more important still, the sense of rhythm is baulked. So subtle is the effect of the rhythmical unity of emotional mood and thought that some teachers of literature refuse to give any explanation of poetry at all, but, having selected a piece within the comprehension of the class they trust to good reading in order to awaken appreciation. They maintain that any intervention of the teacher between the poem and the pupil for the purpose of explaining allusions, linguistic or historical, or arousing images, destroys the artistic unity and prevents the adoption of the æsthetic attitude. Nevertheless, for the majority of pupils some of these aids to appreciation are essential.

RHYTHM

We have seen above that a literary training tends to influence appreciation by developing a sense of rhythm. Now, the rhythm of poetry, music and the other arts is an essential

factor in the subjective adaptation to artistic values on which all appreciation ultimately rests Nor is this to be wondered at when we consider that the external influences of nature which affect life are rhythmical Seasons and tides, springtime and harvest, night and day, occur in periodic alternation producing a rhythm of responsive movements in the organic world. And, superadded to these externally imposed rhythms, there are innate rhythmic activities peculiar to each species, so that the very daisies of the field which close their petals at nightfall continue to do so periodically when deprived of external stimulus. Even the inhabitants of the depths of the ocean, far removed from all external influences, display a physiological periodicity in their vital acts. Not only is the organism, as a whole, rhythmical but the various parts carry on their separate functions as breathing, heart-beat, walking, each at its own characteristic periodic rate And the sucking of the new-born child involves the accurate co-ordination of muscular movements of expansion and contraction in a definite rhythm, timed to correspond with the acts of swallowing The essentially rhythmical nature of vital activity is discerned most clearly when we turn to the functions of the nervous system. Thus certain reflex actions occur in periodic series independently of the nature, the rate, or the intensity of the stimuli which evoke them , and should the stimulus be continuous the rhythmic character of the response is nevertheless unaffected. In short, nervous activity proceeds according to its own rhythmical laws , and the external stimulus is not a determinant, but simply a call to action.

Since the actions of nature and man are rhythmical, the mental life of human beings is naturally adjusted to respond to rhythm There must be something in the mental constitution making rhythmical response facile. And we have not far to seek for an explanation. The mind, as a whole, exhibits a polarity ; at the opposite pole to memory we have expectancy,

a readiness to respond to what is coming. When any process is often repeated a state of expectation is set up leading us, consciously or unconsciously, to expect its recurrence Even the most trivial forms of conscious life exhibit this trait. We only became aware of the ticking of the clock, for example, when it suddenly ceases Although the ticking has affected our subconscious experience, it is not important or intense enough to be noticed. Yet the ticks set up an unconscious expectation that they will continue, which is powerful enough to make us realise that the clock, which we did not previously hear, has stopped. The baffled expectation gives us a start. Such anticipations, and surprise when they are not fulfilled, are aroused whenever a routine of impressions, conscious or not, has been established At a higher level of mental life we observe the same phenomenon. Thus we have unconscious expectations of certain grammatical forms, which gives us a shock of surprise when a blunder is made in grammar. The routine, in this case, is the result of prolonged habit, by reason of which we pay no attention to the grammar but rely on our unconscious expectation of the correct forms Should the habits be not sufficiently ingrained, as with a foreign language, mistakes do not, as a rule, disturb our equanimity.

An alternation of expectation and its consequent satisfaction, with occasional surprises and bafflements, is the psychological explanation of rhythm Prose, on the whole, does not arouse the same certainty of expectation, since the element of routine is not so evident. As Dr I. A. Richards,[28] whose explanation of rhythm is masterly, says, " The way the sound is taken is much less determined by the sound itself than by the [psychological] conditions into which it enters. All these anticipations form a very closely woven network and the word which can satisfy them all simultaneously may well seem triumphant . . . The texture of expectations, satisfactions, disappointments, surprisals, which the sequence

of syllables brings about is rhythm. And the sound of the words comes to its full power only through rhythm."

Metre is a more specialised form of rhythmical sequence, as the expectations are more definitely established by a certain routine of form Consequently, the satisfactions that ensue when the expectations are satisfied have a definite regularity as pleasing as the movements of a dance The mind becomes patterned to a certain series of responses. But since a too rigorous pattern would soon cloy, irregularities in the metre by producing a pleasing surprise, instead of immediate satisfaction, always produce profound poetic effects And further we must note that " through its very appearance of artificiality, metre produces in the highest degree the 'frame' effect, isolating poetic experience from the accidents and irrelevancies of every-day existence. Much which in prose would be too personal or too insistent, which might awaken irrelevant conjectures or might overstep itself is managed without disaster in verse." This is a very good example of what we previously considered, namely psychical distance, brought about by the form of art

Voluntary attention, too, is not a continuous function, but tends to be rhythmical. In the last resort, then, our *experience* of rhythm rests on our nervous and mental constitution Life is rhythm. Sequences of acts of attention yield accentuation, thereby breaking up the most monotonous series of sounds, such as the beats of a metronome, into regular groupings.[34] Each person is possessed of a vital *tempo* based on the periodicity of his vital functions, and it would seem reasonable to suppose that the rhythm of art must in some way correspond to the vital time measure. The nature of the correspondence, however, is very obscure and stands greatly in need of further careful investigation. There is a close relation between vital *tempo* and temperament, or at any rate between *tempo* and mood. Thus, listening to the "Ring"

has been compared with finding oneself in a world where the time unit is bigger than our own, owing to the extreme slowness of Wagner's vital *tempo*, whereas in listening to such an opera as "Carmen" the mind is made to work quickly, owing to the incomparable briskness of the rhythm and phrasing. In the former case one feels slothful and in the latter braced to imminent action. So there are persons who have temperamental preferences for artists who are endowed with a similar vital *tempo* to their own, and to whom, therefore, they are prepared easily to respond But this view of a temperamental correspondence may be challenged, and it can be maintained that the delight of artistic contemplation is due to subtle changes of rhythm involving departures from one's vital *tempo* Art selects and emphasises In a dramatic work such as "Macbeth" the rhythm of actual life is departed from, owing to the exigencies of the stage; there is further the music of the verse varied by lyrical digressions which introduce changed rhythm, and so forth. These digressions or departures from vital rhythm are, it has been asserted, the chief sources of our emotional enjoyment, which comes from the novelty of adjusting ourselves to changes skilfully introduced by the artist Whatever view may ultimately be taken of the relation of the rhythm of art to vital *tempo*, it is clear that the appeal of poetry is a call to the inmost depths of our nature. The metre may be regular or irregular, accented or unaccented, but the one essential feature is the rhythmic experience and its artistic unity with the underlying thought. Use may be made of the dependence of rhythm on muscular movement by teaching boys under fourteen to express the rhythm of poetry by waving short pointers held in the hand accompanied by swaying motions of the body. By such a course of "stick wagging" it has been proved that the most subtle rhythms can be delicately expressed and *felt*.[35]

To M. Jaques-Dalcroze belongs the credit of developing

a new and beautiful system of rhythmical education As a teacher of music he was impressed with the fact that no amount of auditory training, however closely accompanied by finger exercises, gave the capacity for estimating exactly variations of time and rhythmic groupings which are essential to real musical feeling. For " musical sensations of a rhythmic nature call for the muscular and nervous response of the *whole organism.*" Hence he developed a system of special training, happily called eurhythmics, designed to effect a co-ordination of muscle and nerve in all parts of the body, to harmonise mind and body. He is convinced, and the above discussion shews that he is right, that it is only by means of movements of the whole body that we are able to perceive and appreciate rhythm.[36] The training in eurhythmics is a successful attempt to express all the nuances of time—*allegro, andante,* etc., and all the nuances of energy—*forte, crescendo,* etc. in movements of each and all parts of the body. It is a special system of musical gymnastics by means of which sound rhythms are transposed into plastic rhythms of movement. After a year's rhythmic training, the pupil's subconscious mind responds unhesitatingly to any variety of rhythm, he develops, as it were, a limb and trunk speech, resulting in a bodily *feeling* of rhythm. Such training is distinguished from other forms of gymnastics, not only by being a part of musical education, but by its æsthetic value in developing a form of bodily expression which realises the Platonic ideal of physical combined with intellectual culture to produce harmony of the soul. In the words of M. Dalcroze, " Rhythmics aims at the bodily representation of musical values, by means of a special training, tending to muster in ourselves the elements necessary for this representation—which is no more than the spontaneous externalisation of mental attitudes dictated by the same emotions that animate music. If the expression of these emotions does not

directly react on our sensorial faculties, and produce a correspondence between sound rhythms and our physical rhythms . . . our plastic externalisation will become mere imitation. It is this that distinguishes eurhythmics from the old system of callisthenics, musical drill and dancing."

A modified form of this system, which is more suitable for older pupils, is now in use for infants.[37] Time values are taught by stepping to the rhythm of a tune. By simple dances and games very young children can express the varying character of tunes. Phrasing is illustrated by arm movements and changes in the direction of dancing. The recurrence of a musical idea is indicated by walking to the right for one section of a tune and to the left for another. Rhythmic patterns and pulse measures are made by foot and arm movements, and form is rendered familiar through various dance figures. By such delightful rhythmic work infants from the age of five years may become unconsciously familiar with the technique of music through sense impressions of the whole body.

THE CULTIVATION OF TASTE

At several points in this chapter reference has been made to training in technical skill, and composition in the arts generally as a means of cultivating taste We must now face the important question whether creative work is desirable or possible for all. There has been a tendency, in the last decade, to encourage all pupils to do creative work in literature, in the belief that not only will this improve composition, but also help to develop taste. A valuable investigation was recently made to test the latter supposition.[38] Fifty-six college students were divided into two equivalent groups on the basis of tests with a linguistic bias, and also by the use of

certain tests of appreciation. These latter tests were of a variety of forms Certain stanzas of recognised poets were taken, and two other versions composed aiming at a greater and less degree of inferiority. Again, original verses were selected and other versions made in which the emotion was falsified, or the imagery interfered with. Finally, certain stanzas were used differing in poetical value. These three types of tests were submitted to recognised authorities, such as poets or lecturers on literature, who evaluated them; and their consensus of opinion was regarded as the standard. The students had to judge the different versions, and were themselves judged by their agreement with the experts.

One of the two groups had a course of creative work extending over a year, whilst the other group had the usual conventional course in English, consisting of reading from anthologies and discussion. The creative work consisted of exercises in rhyme, rhythm, writing ballads, practice with various figures of speech, writing original verse in various stanza forms and so on. The tests for appreciation were given at the beginning, the middle and the end of the course. The surprising result was obtained that there was no statistical difference between the average mark obtained by the students of both groups at the end of the year. At first sight, this looks as though the creative work, which is now being attempted in many schools, makes no difference to the capacity of appreciation, and that the capacity itself is not capable of development. But, before adopting these depressing conclusions, it is desirable to analyse the results a little more closely, since an average number may hide significant individual differences.

When the individual results were looked into, it was found that there were fourteen students who had made appreciable advances in taste, and of these ten belonged to the group of twenty-seven who had done creative work, i e roughly one-

third. Of the other four, three were very erratic in their results as tested at the middle and end of the course, and only one shewed a consistent advance that could be trusted. During the year it was noticed that the students who had progressed had a natural facility for rhythmic expression, and that their work was on a much higher level than that of the average of the group from the outset, and that they enjoyed it thoroughly. It appears, therefore, that the type of student who is capable of profiting by creative and technical work is the one who has a native facility for such work, and so takes to it readily. The great majority, however, seem incapable of profiting by the training, and in their case it seems undesirable to persist in it as soon as their lack of natural ability is evident. These will never acquire any technical skill in verse, and their time is better occupied by the normal routine of reading and discussion. The others, who are better endowed, gain from their creative exercises an added power of feeling, and a further understanding of the poet's work.

Turning from literature to pictorial art, the cultivation of technical skill in drawing and colour work has for a long time been accepted as part of the general education of all pupils. The technical or executive side, as distinct from the receptive aspect, has always dominated instruction in art in the schools. The idea aimed at has been to encourage all pupils to represent what they see with reasonable accuracy, especially in drawing. In fact, accuracy in representation, especially for older scholars, occupies the first place in most schools, since it is assumed that representational drawing supplies the disciplinary training in technical skill which is necessary for artistic expression. This widely accepted assumption has lately been challenged, on the ground that the use of a medium to represent something is a technical act, and the exercise of technical skill is not necessarily an artistic discipline.[39] "A

painter who manipulates his medium in order accurately to represent the visible appearance of an objective fact may be described as a good technician, if his medium is adequate to his representational purpose; but he can claim to be an artist only by abandoning his representational purpose and manipulating his medium in a manner which adequately expresses an artistic one." The belief that representational accuracy is essential for art is refuted by the history of art, and by the practice of modern artists

In the chapter on "*Sensory Data*" it was pointed out that there was a divergence between what the eye actually sees and the shapes and sizes, in plane projection, determined by the scientific laws of perspective. The laws of perspective are not laws of the ways we actually 'see' As this divergence varies from one person to another, what appears correct to one may appear wrong to others. The constant insistence on drawing what he sees, and the perspective devices usually employed in schools to attain this end, only baffle the child and breed a distrust of his own powers. What he actually does see could only be determined by a special psychological investigation of his own case to determine his index of phenomenal regression So that, for this reason also, the insistence on representational accuracy is not only unjustified on artistic grounds but wrong on psychological grounds. For, representational accuracy can only be judged by mathematical standards, and is a scientific pursuit, not a branch of artistic education.

Moreover, experience has shewn that, just as in literature, a large number of pupils will not improve their technical skill by continued practice, and others will never become accurate enough for their work to have much practical value as representation "A scheme of education which ignores the existence of a relatively ineducable class of executants, by insisting on making its members try to do something

which, in virtue of the limitations of their natural endowment, they are unfitted is wasteful and badly founded. Indiscriminate insistence on executive work of a representational kind instils in many pupils a prejudice against art . . literal accuracy can only be secured by scientifically analysing the visible appearance of things. As such a process is incompatible with artistic expression, representational drawing cannot be regarded as an exercise of the artistic mental power." To secure discipline in the latter it is far wiser to teach craftwork of various kinds, which most pupils are capable of, and to devote more attention to the purely appreciative aspects of art, as opposed to the executive.

It is no doubt correct that, other things being equal, the person who writes, composes music, or paints, has a unique advantage in appreciating works of art, for he gets a glimpse of the soul of the great artists in a way that no amount of reading, listening or looking can accomplish. But, as we have seen, the capacity to do creative work is limited to a minority. For the rest, some form of training in appreciation is not only desirable but essential. Few will need to draw, or paint, or weave, in later life and not many will practice arts and crafts as hobbies; but everybody will have to choose between the beautiful and the ugly in their homes. If they are taught to prefer beautiful furniture, fabrics and other household goods the manufacturers of these articles will in the long run be forced to supply them. Just as the work of Mr E. T. Smith, previously referred to, has shewn that pupils soon come to demand good music if they are made acquainted with it. What the schools can do is to make the pupil acquainted with the better, and the reason for preferring it. They can help him to organise his artistic experiences so that his efforts to appreciate will not be diffuse, ill-directed or wasteful.[40] The aim of art training as a part of general education is to produce a generation which will loathe the ugly and

prefer the beautiful. Art education is to be judged by its influence on the many consumers rather than on the few producers That such training is possible has now been amply shewn by the work done in schools by teachers who are themselves cultivated in matters of taste. A study of the books quoted in the references, in the appendix, will shew the kind of discipline in taste that is now being undertaken successfully by properly equipped teachers. Mechanical methods of reproduction in the last decade, by wireless, etc., has made the world a very different place artistically from what it was To enable pupils to get the best from their environment is an essential part of education, and for leisure hours these devices have taken control of an important part of the environment.

CHAPTER XII

MENTAL TESTS—I

Origin of the Tests—Standardising the Tests—Intelligence Quotient—Revision of the Tests—Mental Growth—Ability and Attainments—Distribution of Intelligence—Group Tests—Some Objections—Samples of the Tests

ORIGIN OF THE TESTS

MENTAL tests of the type discussed in this chapter have been widely used in recent years for a variety of purposes, to distinguish the lower levels of intelligence, to discover the causes of juvenile delinquency, to select children for transference from one grade of school to another, in some cases in order to select candidates for universities, and to give vocational and child guidance. In order to estimate the value of such tests some knowledge of their origin is essential, as otherwise their application may be misconceived In the year 1904 the Minister of Public Instruction in France appointed a Commission to inquire into the training of mental defectives. Mons. A. Binet and Dr T. Simon, two French psychologists, set to work in order to establish a scientific diagnosis of grades of intelligence below the normal. Up to that time three grades of inferiority had been recognised, mental defectives, imbeciles and idiots. Further, idiocy had been distinguished from dementia arising at puberty, which was not necessarily permanent. The French have always been the pioneers in the investigation of mental disease. Two

French physicians whose work we considered earlier, Dr Itard and his brilliant pupil Dr Séguin, laid the foundations of the educational treatment of mental deficiency The latter published a treatise on idiocy in which he put forward the results of his observations: "Man being a unit is artificially analysed for the sake of study, into his three prominent vital expressions, activity, intelligence and will . The predominance of any of these functions constitutes a disease, their perversion leads to insanity; their notable deficiency at birth constitutes idiocy, afterwards imbecility, later dementia."[1] There was, however, no accurate differential diagnosis of such states, although suggestions had been made for grading by means of the greater or less facility in the use of words, or by the degree of derangement of bodily movements. The classification by symptoms was so arbitrary and subjective that no agreement was possible. Dr Sollier had proposed a psychological classification on the basis of attention, according to which imbecility was to be judged by highly unstable attention, and complete idiocy by the absence of attention. The chief objection to such a means of diagnosis, even if its principle were sound, would be the impossibility of measuring voluntary attention *per se*. Every mental operation necessarily involves attention, which is the presupposition of all mental life. Consequently, any test of perception, memory, judgment, or any other faculty whatever, is indirectly a test of attention; but no test can be devised which isolates attention.

The most fruitful plan for mental testing was suggested by Dr Blin, who conceived the idea of examining persons of low levels of intelligence by a series of prearranged questions, referring to such concepts as time, place, number, etc The questions, however, were arbitrarily chosen and no control tests were made, and the marks assigned to them were purely subjective, so that the value of the questions for diagnosis was

not great, nor could comparison be made with the results of other observers. The credit of developing the method scientifically, by standardising questions and securing an objective system of evaluating them, belongs to Messrs A. Binet and T Simon. The new conceptions introduced by them will be considered later Here it is sufficient to emphasise the fact that the working out of the idea of mental testing was due to the practical need of classifying the lowest grades of intelligence.

It was thought at one time, that experiments on the acuity of sensation would yield a measure of intelligence. Theoretical writers also shared in this conviction. Thus Alexander Bain [2] wrote · "We can from the outset discriminate, more or less delicately, sights, sounds, touches, smells, tastes; and in each sense, some persons much more than others. This is the deepest foundation of disparity of intellectual character, as well as of variety in likings and pursuits. If, from the beginning, one man can interpolate five shades of discrimination of colour where another can feel but one transition, the careers of the two men are foreshadowed and will be widely apart." It is worthy of note that some psychologists have held this very opinion with regard to differences of mental imagery; and there is as little justification for the one view as for the other.

It was Francis Galton [3] who first conceived, and put into practice, the idea of measuring intelligence by sensory tests. He used various instruments to measure the sensitivity of different organs, and stated that "the trials I have as yet made on the sensitivity of different persons confirms the reasonable expectation that it would, on the whole, be highest amongst the intellectually able." He also suggested the fruitful idea that the results of such testing should be compared with independent estimates of intelligence by those who knew the persons tested. But this only became possible

when Professor C. Spearman, at a much later date, employed accurate methods of correlation to analyse the experimental results

Professor J. McK. Cattell carried Galton's methods and instruments to America, and his pupil Professor E. L. Thorndike greatly extended and refined the methods, and devised new varieties of tests of a perceptual rather than of a sensory kind. During the last decades of the 19th century the idea of mental testing waned in England, but was actively pursued in America, Germany and France Various kinds of sensory tests were employed, such as measuring the 'spatial threshold,' i.e., the smallest distance to which the points of a compass must be stretched in order that they may be discriminated as two. It was found that, for this test, young children were as sensitive as old, dull children as bright, and savages more sensitive than civilised people. Other tests dealt with visual or auditory acuity, discrimination of colours or tones, and so forth. When these proved disappointing and gave conflicting results, tests of a more active nature were used, such as the rapidity of muscular movements, reaction times to various stimuli, and others demanding active manipulation. The assumption underlying all such investigations on sensory and perceptual processes, was that the physiological limits of the sense organs were roughly the same in different persons; and that the discrimination of the data supplied by the sense organs would test the power of attentive analysis, which was identified with intellectual capacity However, the results obtained were mutually conflicting, and many of the conclusions of these early workers were in conflict with their data, owing to the lack of suitable statistical methods

A little reflection should be sufficient to convince anyone that acuity or integrity of sensibility can stand in no direct relation to intelligence. Persons like Helen Keller and other

blind deaf-mutes, who lack what might be regarded as essential sensations, are nevertheless capable of developing very high degrees of intelligence Again, the attempt to estimate the level of intelligence by the accuracy of memory would be futile, for there is no necessary correlation between intelligence and memory, as persons of low intelligence may have good memories. Similarly, all single tests seem bound to fail. Binet was amongst those who had employed the sensory and motor tests; but in attempting to examine the intelligence of children suspected of deficiency he abandoned them, and was driven to adopt tests more nearly approximating to the practical activities of ordinary life. "Instead of measuring the intensity of simple faculties, the vain ambition of the psychophysicists, we shall measure acts of adaptation. Understanding the normal progress of development, we shall be able to determine how many years an individual is advanced or retarded." With these considerations in mind Messrs Binet and Simon attempted to solve the difficulty by selecting a number of heterogeneous tests, in order to explore as large a part of mental life as possible. They produced, in fact, a battery of tests which could be aimed at different heights so as to determine the intellectual level of the individual. So much importance was attached by them to variety and number of the tests that Binet, comparing the relative importance of a number of tests with a single one, states that he would almost be prepared to say: "no matter what the tests are provided that they are numerous." Now, it is obvious that the degree of education of a person will make some difference to his ability to deal with certain tests. Thus, a test involving the power to calculate will, other things being equal, be answered best by one who has been taught arithmetic. It would be desirable, therefore, as far as possible, to eliminate acquired knowledge if a measure of intelligence is desired, and to devise tests to discover 'mother wit' only; unless indeed

the capacity to acquire education is part of what is meant by intelligence. This ideal method, however, has proved impossible of attainment.

A large number of tests were selected by Binet and Simon in 1908 and revised by Binet in 1911. Their idea of what is meant by the intelligence, which is tested by the tests, is best stated in their own words, thus, " To judge well, to understand properly, to reason well, these are the essential springs of intelligence " They also included certain other powers, chiefly initiative and " practical sense " or adaptation to novel circumstances. In thus leaving behind the artificially simplified laboratory tests and introducing everyday complex conceptions Binet was, in effect, aligning himself with common sense methods which, in some form or other, had always been employed to detect the lower grades of mentality. Thus, in the reign of Edward II we find a legal definition of a ' sot,' as " such an one who cannot tell who are his father and mother, nor how old he is, nor is able to count and number twenty pence, so that it may appear that he hath no understanding or reason of what is to his profit, or what is for his loss."

STANDARDISING THE TESTS

It was pointed out above that any test which is to have a diagnostic value must be standardised. We owe to Binet and Simon the ingenious device of standardising their tests by the ability of normal children to cope with them This can best be illustrated by considering an actual test and the method of dealing with it. Suppose a number of ordinary children are asked whether they know what a butterfly is, and what a fly is ; and then are asked to state " In what way are they not the same ? " Experiment shews that at the age of five years normal children are not capable of making the comparison

necessary to distinguish such a simple difference. Although they know the two things quite well, they are not able to understand in what way the two things differ. By the age of seven years the transition has been made, and about two-thirds to three-quarters of normal children are able to make the reasoned comparison. In order to make the test more complete and fair, three such differences are asked, namely between a fly and a butterfly, wood and glass, paper and cardboard. It was found that the majority of normal children of seven years were able to state two out of the three differences. In consequence this degree of correctness was accepted and the test was assigned to the age of seven years. Normal children of this age have therefore tested the test, and if they are a fair unselected sample of children it is assumed that any other normal child of seven will be able to supply at least two out of the three differences. A separate collection of such tests has been standardised in the above-named manner for each age from three to sixteen years. In this way the conception of mental age arose This early method of arriving at the mental age for any test is not statistically sound, as the intelligence of an older group of children is spread out more than that of a younger group. In order that a test should be assigned to the mental age of seven years, it should be passed by approximately 50 per cent of normal children who are of the real age of six years at their last birthday ; and so on for every other year of mental age. By this device, the average mental age is made to coincide with the average chronological age. An instructive fact has been observed which shews the superiority of this experimental method over any *a priori* procedure. Normal children of the age of seven years can state a difference between two things, e.g. paper and cardboard, yet they find it much more difficult to say how they are similar to one another, so that the majority fail, and the statement of resemblances between

common things cannot, therefore, be used as a test for this age.

For the various ages Binet and Simon used a collection of tests, involving various tasks, such as verbal memory, memory of digits, power to understand and carry out an instruction, comparison of length of lines, arranging small weights in order, tests of suggestibility and a number of tests involving the correct use of language. Having tried all these on normal children, they then proceeded to use them to test mental defectives, imbeciles, etc In this way it was possible to compare abnormal children with normal, by tests which were objective, and therefore impartial, and to which a more or less definite value could be attached; thus securing a reasonable diagnosis.

It is necessary to draw a distinction here, the neglect of which is likely to lead to serious error. The tests we have been describing do not measure mental ability in the same sense that a test of skill measures a particular kind of talent, hence we must distinguish between ability and maturity. The tests are intended to shew that an individual displays intellectual activity of a more or less mature type.

It does not necessarily follow that a child who does well in the tests will certainly acquit himself with credit in school work, for the ability to do well in school tasks depends on a large number of factors of which intelligence is only one. Thus, scholastic ability demands docility, regular habits, continuity of effort over prolonged periods, and so forth. Such factors hardly come into the tests at all, and the personality of the examiner is usually sufficient to secure maximum attention to the task in hand during the short time that the tests are being given.

A distinction must also be made between maturity and accuracy of intelligence. Intelligence may be mature without necessarily being correct with regard to particular pro-

cesses, owing mainly to lack of interest in certain directions. Nevertheless we may agree that, on the whole, want of rectitude in a very simple process, provided that we are sure that interest is sustained, is an indication of immaturity.

INTELLIGENCE QUOTIENT

In the final rearrangement of his tests Binet had standardised a set of five for most years up to the age of fifteen and a final set of five for adults. To find the intellectual level of any individual he gave the tests in order, and found the extreme upper set in the whole series which the child could pass with but one failure, beyond this point a credit of one year was given for every five tests, chosen from any of the higher sets, which were answered correctly. By this method he assigned a mental age to any child. The method indicated above has been used by subsequent investigators, so that we may roughly define a mental age as the ability to cope with most of the tests which normal individuals of that age can deal with, provided that credit is given for successful attempts with tests that are usually answered by normal persons of a higher age.

When Binet had found the mental age of a child he compared it with his chronological age and determined by how many years he was retarded or advanced. This, however, is obviously not satisfactory. For, the significance of the amount of retardation in mental maturity depends on its relation to the real age of the child. For this reason Professor W. Stern,[4] of Breslau, introduced the concept of the intelligence quotient. If an individual's mental age is divided by his chronological age the quotient obtained indicates his level of maturity compared with that of normal individuals. This number has been called the 'intelligence quotient' (I.Q.)

or the 'mental ratio.' [5] Thus a child of eight years who has a mental age of six has a mental ratio of $\frac{6}{8}$ or 75 per cent of normal maturity. We may, perhaps, say that the mental ratio is a measure of the brightness of a child, for one who is above the normal maturity for his age would usually be called brighter than the average, and one below the normal, dull It was believed, on the evidence of mental tests, that maturity of intelligence is practically complete at the age of sixteen years, consequently in finding the mental ratio of adults sixteen was taken as the denominator of the fraction for all persons above sixteen years of age. We shall consider the validity of this belief in a later section. As the rate of progress towards complete maturity is not constant but slackens down, it must be remembered that a normal individual of mental age fifteen is much nearer to one of sixteen than a child of mental age five is to one of six.

There are two slightly different meanings of the term 'mental age.' A mental age of ten years may mean the average score of marks obtained by a standard group of children of chronological age ten years. This is the accepted definition in using group tests, which will be described later. But it may also mean that particular test score the average chronological age for reaching which is ten years. These two meanings may coincide, and for children not much ambiguity arises But for adults the two meanings will not usually coincide, and incorrect notions about the limits of mental growth may arise in consequence of this We may illustrate the difference by considering the height tables usually found on weighing machines. If a man knows his height he can read off his probable weight. After he has weighed himself he would need another table to find the average height of men of his own weight. It is only when the two quantities, height and weight, are perfectly correlated that the two

tables would coincide. This is more nearly the case with children than with adults [6]

In addition to tests of intelligence, and following the same procedure, certain scholastic tests have been standardised by trying them out on normal pupils in ordinary schools at various ages. There are tests of reading (both speed and comprehension), tests of spelling, arithmetic (mechanical and problems), handwriting and composition and so on. By the use of norms, found in the same way as intelligence norms, it is possible to assign a scholastic age to a pupil for a specific subject. As these tests decide what a boy or girl has achieved in school they are called tests of attainment or achievement. By making use of a combined test of various school subjects it is possible to arrive at an Educational age, and dividing this by the chronological age we arrive at the Educational Quotient (E.Q.) More important, from the teacher's point of view, is the Achievement Quotient (A.Q) obtained by dividing the educational age by the mental age. In this way we can estimate whether a pupil has reached a standard of attainment consistent with his native capacity.

REVISION OF THE TESTS

The Binet-Simon tests have been subjected to a thorough-going examination, rearrangement and revision. Two of the revised scales are sufficiently noteworthy to be considered in some detail. Professor L. M. Terman of the Leland Stanford University produced a revised scale called the 'Stanford revision.' [7] He compared all the tests that had been previously used in all countries, and included several others for the purpose of experimenting. By choosing schools of average social status, and taking all the pupils of different ages in such schools who were within two months of a birthday, he exam-

ined a thousand children between five and fourteen years selected simply on the ground of age. Using the old and some new tests, he arranged them in sets for each year in such a way that the median mental age of the children of each group coincided with the median chronological age. If the median mental age at any point of the provisional arrangement was too high or too low, the location of some of the tests, or the standard of marking, was changed to secure the above result, Some 400 adults were treated in the same way ; so that finally sets of standardised tests were obtained for each age from three years to fourteen years, and sets for adults and ' superior ' adults. The tests, as a whole, treated in the above manner are, therefore, arranged so that the average individual of those examined obtained an intelligence quotient of unity. Each single test within a set was further standardised by arranging the children of each age level in three groups, thus : inferior with a mental ratio below 90 per cent, superior with a ratio above 110 per cent, and an intermediate group. The percentage of successes for each test at or near the age level was found for all three groups, and if a test failed to shew a decidedly higher proportion of passes in the superior group than in the inferior it was not regarded as satisfactory.

Not only were the tests standardised, but the procedure for giving each test was carefully elaborated, and the method of marking was strictly defined. In brief, it may be said that the attempt was made to standardise the examination and the examiners. This rigidity of procedure applied to the Binet-Simon tests was found to reduce the mental ages in the lower part of the scale and to raise them in the upper part, i.e. above ten or eleven years.

When the mental ratio for the separate age groups from five to fourteen years were plotted on a frequency diagram, it was found that their distribution for each age was fairly

symmetrical The similar nature of the distribution at each age suggests that an individual's intelligence quotient remains constant, and re-tests of the same children at different ages seemed to confirm this, i.e. bright children do not deteriorate nor the dull improve. The coefficient of correlation between the estimates made by teachers and the results yielded by the tests was found to be ·48 as measured by the Pearson formula; not a high figure for this kind of work As far as the average intelligence quotients at each age were concerned very little difference was found between boys and girls from five to fourteen years.

The frequency of the mental ratios was not only symmetrical, above and below the median, but decreased gradually on each side, so that there appeared to be no definite dividing line between the normal and the mentally defective. Consequently, the number of mental defectives in any population would appear to depend on what particular mental ratio is chosen as the standard of defectiveness. Professor Terman regards an intelligence quotient below 70 (i e $\frac{7}{10}$) as shewing definite feeble-mindedness; and amongst his thousand cases, one per cent were marked as low as this

A most scholarly and thorough revision of the tests has been made by Professor Cyril Burt, who has introduced certain refinements of procedure and analysis based on modern statistical theory He found that, in their application to English children, the tests required much re-assortment both in the order of difficulty and in the age assignments. He insists more strongly than others that in giving the tests the examiner should adhere with meticulous exactitude to a standardised procedure; for the tests are not intended primarily to discover how the individual carries out certain operations *but how he responds to certain standardised formulæ*. The examiner should neither teach, nor criticise, nor give any clue as to whether the answer is correct or

not; and further all emotional excitement other than encouragement should be avoided as far as possible.

With these ideas in view, careful standardised directions for giving each test were worked out, mainly based on M. Binet's procedure but supplemented by that of other competent investigators. Professor Burt believes that for English children, in the present state of our knowledge, the Binet-Simon scale should be used as far as possible as Binet left it, and his revision consequently is very conservative. His procedure is set out in detail in an excellent book called *Mental and Scholastic Tests* which should be studied by all who wish to use the Binet-Simon scale, and the statistical methods employed are described simply and clearly in his *Distribution and Relation of Educational Abilities* [8]

He examined over 3,500 children in London schools, comprising above 2,600 normal children in ordinary elementary schools, over 700 in mentally deficient schools, and more than 100 juvenile delinquents in industrial schools, etc. The tests were given to children of all ages from three and a half to fourteen and a half years, and the average percentages of all the children, at all ages, who passed each test were calculated. The figures so obtained made it possible to arrange the various tests in order of increasing difficulty, as estimated by the percentage of passes. Now an ideal scale of intelligence would be one in which there was equal difference of difficulty between any two tests at all points on the scale, i.e. in which all the units were of the same size. Such accurate graduation is not possible with the Binet scale; but Burt shewed that, if the percentage of passes is converted into terms of units of standard deviation, there is a rough equality of units between the tests assigned to the intermediate ages from seven to twelve. An approximate scale of difficulty, comprising sixty-five tests was accordingly constructed by using these units.

There are serious discrepancies between Binet and other investigators in the assignment of various tests to the different ages, for Burt in comparing his age assignments with those of twenty other investigators found that only four, out of his sixty-five tests, were allotted to the same age-group by all of them, so that the concept of a mental age is not as precise as we should like it to be.

A very interesting fact was brought to light by this revision, namely, that the order of difficulty of the tests is not the same for normal as for defective children. The order varies greatly with the nature of the test Thus the following were found to be relatively easier for normal children ; scholastic tests, especially those involving the use of language and other tests of a linguistic kind ; tests which are learnt early by normal children such as counting backwards, etc. ; tests of immediate memory and tests of reasoning. Whereas those which proved to be easier for defectives were tests of suggestion and general information, such as naming coins and common objects, picture tests involving description and interpretation, mechanical counting, simple money tests such as giving change for twopence out of a shilling by the use of coins of different value, and so on. Consequently, scholastic tests turn out to be among the best tests of intelligence ; and linguistic disabilities are, on the whole, the distinguishing feature of defectives. It will be remembered that some of the investigators who preceded Binet proposed to classify the lowest levels of intelligence by defects in the use of words, and apparently they were on the right lines although their methods were crude. Moreover, it would appear that inability to profit by ordinary school instruction, in so far as it is not due to emotional or moral defects, is a clear indication of lack of intelligence. The application of the scale to defectives yielded the result that they advanced only just over half a year in mental age for each chronological year,

so that the absolute amount of mental retardation increases steadily.

It was stated previously that mental age does not grow uniformly but slackens down with increasing years This is further evident from the fact that any particular chronological age-group trenches very deeply in mental age on its successors; even in the lowest age-groups this overlapping is considerable but it becomes greater still in the higher ages; between the ages of thirteen and fourteen the amount of overlapping is as high as 77 per cent.

The frequency diagram for mentally defective school children, constructed on the basis of the revised tests, considerably overlaps the diagram for normal children. In general intelligence, as measured by these tests, more than half of the defective children could be easily matched by children in ordinary schools there is thus no break between the two groups. Accordingly, Burt defines a mentally defective child "as one who for intelligence ranks among the lowest one and a half per cent of the school population of the same age." As tested by his scale this was shewn to be equivalent to a mental ratio of 70, in other words a deficient child is backward by three-tenths of his age. The fact was previously noted that this same intelligence quotient was found by Professor Terman by a less rigorous method.

We stated that those who rely on mental tests to measure intelligence usually assigned a mental age of sixteen as the limit of growth. A mental ratio of 70, therefore, would be equivalent to a mental age between eleven and twelve for mentally deficient adults. Professor Burt, however, thinks this is much too high, for an adult who is not capable of coping with the tests, or with school work, may yet be able to adjust himself to the demands of practical life so as to be self-supporting, especially in the lower grades of labour. Comparatively little weight should be given to mere mental age as far as adults are

concerned, since success in practical affairs makes greater calls on other factors such as temperament, emotional stability, physique, environment, etc. A mental ratio of 50, corresponding to a mental age of eight may be regarded as the border-line for adult mental deficiency. This means, in practice, that for the adult population of the country between three and four per thousand are defective.

Using the evidence provided by the revised Binet scale together with that obtained by the reasoning tests, Professor Burt concludes that an intelligence quotient above 115 or 120 indicates central school ability at least, and a ratio above 130 or 135 scholarship standard for secondary schools. These figures may be compared with those of Professor Terman, who regards quotients of 110 or 120 as indicating 'superior intelligence,' whilst quotients between 120 and 140 indicate 'very superior intelligence' An intelligence quotient above 150 is very rare indeed, and Burt has never, in all his researches, found a ratio above 160 in a public elementary school, though he discovered a boy of seven years with a ratio of 190 in a private school.

The use of the tests has shed some light on the causes of juvenile delinquency. By examining over one hundred individuals in industrial schools and other places of detention Burt concluded that these potential law breakers were technically 'backward' but not 'deficient.' They were retarded by nearly two years in general intelligence, but by four years in educational attainments. The low estimate for general mental level, discovered by several observers amongst delinquents generally, is largely to be explained by the educational backwardness of such offenders. For, the chief factors in the causation of delinquency are, as a rule, emotional rather than intellectual, and the share contributed by real mental defect has been greatly exaggerated.

Messrs R. M. Yerkes and J. W. Bridges [9] decided to adopt a

new mode of marking, more especially in the case of psychopathic individuals in whom they are chiefly interested. They constructed three 'point scales for measuring ability' for infants, pre-adolescents and adults, each consisting of twenty tests. The pre-adolescent scale has been most widely used and the tests in this scale, with one exception, are closely modelled on, or exactly like, those of the Binet-Simon scale. All the tests of a similar nature, as, for example, those for the immediate memory of digits, which Binet placed in different years according to the number of digits remembered, are grouped into a single test and given together, in increasing order of difficulty. In the Binet-Simon method of marking the all-or-none principle is used on the whole, i.e. the subject either succeeds or fails; whilst in the point scale there are graduated subdivisions, so that the twenty tests consist of over fifty questions, and credit is given for partial successes. The results of the examination are expressed in total scores ranging from 0 to 100, and by the help of a table of norms, constructed from the results obtained from normal individuals, a test score may be converted into a mental age Theoretically the entire point scale is given to each individual examined, but in practice this is not necessary with very young children who break down with the earlier subdivisions of any test, so that the later are unnecessary The idea of giving the same tests at all ages is sound, since genetic psychology favours the view that all the important types of intelligent action are present germinally at about the third year of life, and subsequent development involves, not new forms but increasingly complex examples of functions already present in embryo. It is maintained that the point-scale method is definitely superior to other varieties for testing psychopathic subjects and delinquents, and that it is more amenable to statistical treatment, but neither of these claims has been justified by experience.

MENTAL GROWTH

Much discussion has centred round two fundamental topics in the theory of mental measurement, namely the rate and limits of mental growth, and the constancy or variability of an individual's intelligence quotient. There is much conflicting evidence on both these points. In the first rush of enthusiasm the earlier workers believed that the mental ratio of a child was fixed and definite, and would cling to him for the rest of his days Subsequent research has thrown some doubt on this conclusion. Dr E. A. Doll, for instance, as the result of repeated examination of the same feeble-minded persons over a series of years concluded that the mental ratio was so fluctuating as to be worthless for prognosis. Professor Terman who, as we saw above, believed that the ratio was constant has recently taken up a much more cautious attitude He points out that the intelligence quotient is subject to a serious mathematical disqualification on the ground that its probable error is relatively very large, as is also that of a mental age. The intelligence quotient for psychopathic subjects does not, according to his later view, always remain constant, and for normals, its constancy is only approximate, or rather expresses a tendency

Dr J. E. W. Wallin examined over a hundred children who failed to make satisfactory progress in a special school for subnormal cases. He tested them at intervals varying from half a year to six years, and found that the intelligence quotients in several cases differed by several units. He concluded that "it is frequently impossible to determine for years whether a young mental subnormal is feeble-minded or not." He made use both of Binet's earlier and later scales and of the Stanford revision, obtaining similar results with each of them, and inferred that the differences in the quotient, however

measured, are too large to be ignored, and, in individual cases surprisingly large. Later he compared the Stanford revision with certain group tests, and concluded that the inconsistencies as to mental age are so glaring that mental tests give no reliable means of grading pupils for the purpose of instruction.[10]

Investigations on normal children have so far led to a contrary view. Pupils from eight to sixteen years of age were re-tested by the Stanford revision at different periods, 43 at intervals of four years, 127 after two years, and 298 after a year For the year's interval the difference of intelligence quotient ranged from 7·2 to 4·2. For all the intervals combined only 8 5 per cent of the cases shewed a difference of more than ten points, and 89 per cent had a difference of eight points or less. The duller pupils seemed on the whole to lose a small amount and the brighter to gain.[11]

A careful re-examination of elementary school children up to the age of fourteen, by the same tests each time, shewed a similar state of affairs.[12] The fluctuations that were observed were attributed to the method of marking, which assigns so many months to each test passed. It was observed that practice in the same tests once a year appeared to have little effect, since the children are never told whether their answers are correct, and the same wrong answer is, on the whole, apt to be given in successive years. There were 371 children examined (169 boys and 202 girls) and some of them were re-tested at the end of the first, second and third years after the initial test, and 42 at yearly intervals of four years. The following table shews the changes in mental ratio observed.

Interval	1 *Year.*	2 *Years*	3 *Years*
No of cases .	204	110	57
Median change	+ 2	— ·6	0

The middle 50 per cent of the change for the three years was

between the limits of $-5{\cdot}1$ and $6{\cdot}0$ points The next table shews the changes for those examined four times·

	1st Test	*2nd Test*	*3rd Test.*	*4th Test.*
Average mental ratio	98·7	102 2	102 4	99·7
Change . .	—	+3 5	+·2	−2·7

The correlation coefficient between the marks of the first and fourth test was 84.[13]

Similar conclusions were reached by Professor H. O. Rugg and Miss Colloton [14] after reviewing all the previous work on re-testing of about 1,500 cases, and themselves testing and re-testing at intervals of about a year more than 130 individuals by the Stanford scale. They came to the conclusion that confidence could be placed in the approximate constancy of the mental ratio The average difference, found by all previous investigators, for intervals ranging from six months to five years was, according to their calculations, five units. The typical positive differences (taking only the middle 50 per cent of cases into account) were less than six points and the typical negative differences three points They found also that the coefficient of correlation between the first and second of their own tests was ·84.

By the use of his revised scale on different groups of defective children, between the ages of six and a half and fourteen and a half, Professor Burt demonstrated that the mental ratios varied but little, on the whole there appeared to be a drift towards diminution. He annually examined the same set of 34 individuals in mentally defective schools for six successive years. The average ratios dropped from 63·7 to 57·1 and, in all but eight cases, the ratio was smaller at the end of five years than at the beginning. Another test, made in two successive years on 72 children in a school for defectives, shewed that 2 had remained constant, 17 had declined, but 53 had definitely advanced. In one case the advance was sufficiently great to enable the child to reach a mental ratio

of 90, which is high enough to be considered normal. This instance is not typical, for seldom do such children advance one mental year per annum. Burt states that, although the rule is not established, the weight of evidence seems to shew that with subnormal children "low mental ratios tend to become yet lower with the lapse of time."

A similar conclusion has been reached by independent observers [15] with regard to border-line cases, i.e. children in ordinary schools who are referred for special examination as to their mental condition. By examining about 60 such children with the Stanford-Binet tests at different intervals, ranging from one to four years, it was found that half of them shewed a loss in mental ratio on the second occasion, the average drop being 6·3 points. The tendency to decline was most marked in those whose initial ratios were between 60 and 80.

It seems, then, that there are cases of deferred maturity, where development is not arrested but postponed. Such cases are also found in children in ordinary schools, so that in London a second scholarship examination is held for those who 'bloom late.' There are also individuals of an opposite kind whose mental deficiency may be deferred till a later date, but such instances are very rare indeed.

The evidence collected up to date has been recently reviewed,[16] and it appears that, for normal children, the intelligence quotient varies but little over a period of three, four, or even five years between the date of the original and final examination. For gifted children, such change as occurs appears to be in an upward direction and is greater than for ordinary children. Whereas we have seen that, for children of low mentality, the change tends towards the downward direction.

The fact that the mental ratio appears, on the whole, approximately constant, for normal people, has led to the

assumption, which is apparently justified by experiment, that intellectual growth as measured by the Binet scale is not uniform from year to year but steadily decreases with age and finally ceases. Many investigators have accordingly used a mental age of sixteen for all adults in finding their intelligence quotients, this being the age at which growth in intelligence is supposed practically to cease. Using the point-scale method Messrs Yerkes and Wood concluded that the rate of intellectual development diminishes from the fifth year onwards; between the years sixteen and eighteen there is a slight, irregular increase, which ceases almost entirely at eighteen years. Later observers have suggested a surprising limit of thirteen or fourteen years, which was based on the results obtained with the American army tests Burt, however, as the result of more careful measurements, adheres to the age of sixteen as the limit. Dr P W. Ballard,[17] by the use of graded 'absurdity tests,' in which marks were given for detecting and explaining absurd statements, found that in two large secondary schools the maximum marks were obtained at the age of fifteen years. By extending his investigations so as to include about two thousand individuals, and pooling the results, he concluded that the rate of growth of intelligence gradually slows down, does not improve much after twelve, and is almost imperceptible at sixteen. A year of mental age is consequently not a fixed unit, but gradually increases as we ascend the scale of life. It should be observed that although the growth is very small after sixteen yet, as it still continues, there may be a measurable amount in a decade.

These conclusions should be compared with the results of a research by means of a group test given to English grammar school girls and boys and university students.[18] There were 227 boys and 37 girls examined, 87 university men and 97 women; and in addition, for purposes of comparison, 8 men

and 18 women with degrees in Honours, and 6 university professors and lecturers. The group examination consisted of tests of synonyms, analogies, mixed sentences, completions and reasoning, one mark being assigned to each correct answer. In order to make the marking mechanical, alternative answers were printed and the subjects had simply to underline the correct answers The table below shews the results (omitting decimal points) for all the subjects, the maximum possible mark being 189

Age	11–12	12–13	13–14	14–15	15–16	16–17	16–17	17–18	17–18	22½	23
Sex	B	B	B	B	B	G	B	G	B	M	W
Marks	84	91	100	109	112	116	125	129	131	130	127

The Honours students and lecturers gained the following marks :

Age	22 y 2 m	22 y 7 m	Professors, etc
Sex	W	M	—
Marks	131	142	175

The correlation of the marks of the various groups of boys and girls with the teachers' estimates was from 62 to 78. It will be observed that the marks steadily rise till about 130 but are not appreciably higher for the university students than for the older schools pupils. There is an increase up to about seventeen years and little or no increase thereafter, whence the investigator concluded that " Intelligence, apart from experience, ceases to grow, except among men of exceptionally high ability." It must be remembered that the same total score, in such a group test, can be made from widely different scores in the individual tests, and consequently only doubtful value can be placed upon a single crude figure obtained in this way. Thus, in the reasoning test alone, the marks at seventeen years of age were two and a half times those obtained at the age eleven to twelve years, and this was slightly increased amongst the university students , so that an intelligence quotient based on reasoning tests only would shew a different result. It is instructive to compare the

figures just given with those obtained by the same group test given to all the six hundred boys in Rugby School.[19] As in the former case, the boys had simply to underline the correct reply In a previous test at the same school, on a smaller group, the results had been found to correlate with the masters' independent estimates of intelligence to the extent of ·83. The head master stated that, from his knowledge of the boys, the results were a good indication of a boy's industry and "teachable ability." The maximum possible mark this time was 200 and the following tables, as before, give the marks to the nearest whole number; but for purposes of comparison with the previous table the numbers must be proportionately reduced.

Upper School	*Classical Side School Forms*					*Modern Side School Forms*				
Age (y and m.)	17 8	17 11	16·4	16 2	15 6	17·8	17 4	17·1	16 6	16 5
Marks	$163\frac{1}{2}$	160	157	142	155	$160\frac{1}{2}$	150	137	146	136

Middle School.	*Upper*						*Lower*					
Age	15 9	16 0	15 8	15 4	15 1	14·11	15 3	14 11	14 8	14 5	14 5	14 6
Marks	141	144	$128\frac{1}{2}$	$131\frac{1}{2}$	130	$132\frac{1}{2}$	114	$120\frac{1}{2}$	120	122	$114\frac{1}{2}$	$109\frac{1}{2}$

Lower School—Age 13·11 Average mark 106[20]

The head master thinks that the above figures "seem to disprove the contention that there is very little change in a boy's intelligence between 16 and 18"

The head master's belief is correct and is supported by a growing body of expert opinion, whereas the contrary view is based on the inadequacy of the tests themselves and on an incomplete analysis of the results.[21] Professor Thorndike applied careful statistical analysis to the figures obtained from a composite test of intelligence given to nearly nine thousand high-school pupils from thirteen to nineteen years of age. He inferred that the ability to improve on an earlier score continues to grow beyond the age of eighteen amongst those who are receiving intellectual education. A most comforting conclusion for those who value education; for, after all, we can only expect intelligence to grow if it is being exercised.

This important question of the growth of intelligence has been tackled with more refined statistical methods. A mental age depends on the number of tests correctly answered by the individual, and one is easily led to the mistaken belief that all the items are of equal numerical value. Similarly, in the investigations above considered, the units employed are the marks scored; but we know that these units are not of equal value For, as it is increasingly difficult to score more marks in any group-test the higher the score already obtained, it is clear that the units are becoming greater in absolute value. Nor can we be sure that equal scores represent equal levels of intelligence, since the scores may come from different test items whose difficulty varies It is dangerous, therefore, to make any inferences about mental growth unless we are able to measure intelligence in units equal at all parts of the scale

In the next section it is shewn that the distribution of intelligence in the general population follows the 'normal curve,' and the same is approximately true of the distribution in any single age-group. Professor L. L. Thurstone [22] has shewn that, with this distribution, it is possible to convert test scores into absolute units The data needed for this conversion are a knowledge of the percentage of persons at each age who pass each test item, and the amount of overlapping between successive age groups. We can then either choose the mean score of the lowest age group we examine as the zero point or origin for our measurements, or determine an absolute zero by extrapolation. Each item in a mental test can thus be evaluated in equivalent units of standard deviation, just as we may measure temperatures from absolute zero.

This method was used by Messrs C. A Richardson and C. W. Stokes in a most careful and thorough investigation.[23] The children in the town of Blackburn who were over the

age of six years and under fourteen were given a mental test. No selection was made, but all the children, some 12,000, in every variety and grade of school in the borough, who were present on a particular day, took the test

The mean scores, out of a possible total of 100, and the deviations were as follows

Age . . .	6+	7+	8+	9+	10+	11+	12+	13+
Score . .	11 3	23 2	32 0	39 6	45·3	53 2	59 3	63·6
Standard deviation	10·2	12 7	12 9	14 0	14 8	15·0	14 9	16·2

The scores obtained by every pupil were next converted into marks on the absolute scale, and the average mark for each age was calculated in these units, together with the standard deviation from each average. Such deviations give us a measure of how intelligence is spread at each age. Now, just as the runners in a race spread out more the longer the race continues, so it was found that the standard deviation increased with increasing age; being, in fact, proportional to the mean level of intelligence at each age in absolute units.

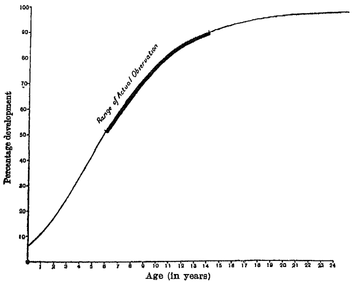
Evidence has been obtained to shew that natural growth in various living processes follows a course described by Gompertz's equation, namely $Y = Ca^{b^x}$, where Y is the amount of growth at time x, C is the amount at maturity, whilst a and b are constants depending on the particular living process studied. If we put $y = Y/C$ so that y is the proportion of the maximum possible growth reached at the time x, we get $y = a^{b^x}$ and the curve is called a G curve. In the Blackburn investigation the following results, in absolute units, were obtained, shewing the average percentage of development from absolute zero at each age for the 12,000 pupils.

Age . .	6+	7+	8+	9+	10+	11+	12+	13+
Per cent .	55 5	63	69	74	78·5	83	86	89

This is very nearly a perfect G curve. The curve is shewn in the text, the thick line indicating the range of actual

observation, and the thin continuation in both directions the parts extrapolated by calculation .

Not only is the mean growth curve for the whole population of this form, but also that for each person , though, of course, the constant C differs from individual to individual The curve shews that during school years, from the age of six,



MEAN PERCENTAGE GROWTH CURVE OF ABILITY.

we are dealing with only the upper half of a child's intellectual development , and that by the age of eleven, at which age a change of schooling occurs in England, the pupil has attained over eighty per cent of his maturity These results must be accepted with caution, as there is some doubt as to whether some other curve might not fit the observations, and the validity of the extrapolation is still more doubtful Nevertheless they are the best we have, and are suggestive. We see, now, why the early investigators found it so difficult to detect any increase of intelligence after the age of sixteen years, since, whilst growth still goes

on after this age, the rate of acceleration measured in absolute units slows down considerably, and, we may infer from this, and all our previous evidence, that intellectual growth only continues provided that educational stimulus is offered. A country which keeps its children at school till a late age reaps a rich reward, by helping to attain levels of intelligence which would otherwise not be reached

ABILITY AND ATTAINMENTS

From what has been said it is clear that success in the Binet-Simon tests is not dependent on ability or maturity alone. Indeed, ability and maturity *in vacuo* are empty conceptions, and the attempt to measure native intelligence or ' mother wit ', apart from the material on which it is exercised, is seductive but impracticable Among the hosts of influences which determine the score obtained in the tests by any individual the chief is undoubtedly educational opportunity; in fact, many of the tests are direct measures of school work. Hence, those who appear most retarded mentally are still more retarded educationally, feeble intelligence results in still feebler scholastic acquirements.

Using the method of partial correlations, Professor Burt calculated that, of the mental age of a child found by the London version of the tests, " one-ninth is attributable to age, one-third to intellectual development, and over half to school attainments. School-attainment is thus the preponderant contributor to the Binet-Simon tests." The validity of this method of assigning definite amounts to each cause has been questioned; but there is no doubt that school attainments do influence the results to some extent.[24] When the effects of age and intelligence are discounted the tests, contrary to a widespread belief, shew little correlation

with ability in arithmetic but a decided correlation with linguistic subjects, especially composition From this, it would be reasonable to conclude that the best single indicator of a child's intelligence would be found in his ability in composition.

The connection between scholastic attainments and the ability to do well in mental tests has been confirmed by an investigation of certain selected groups of metropolitan children.[25] Mental ratios were found by means of the Stanford-revision tests, and educational ratios, by means of very simple standardised tests of reading, adding, subtracting and spelling The tests were given to children in special schools for physically defective children, to canal-boat children, and to gipsies. Amongst over 150 physically defective boys and girls, mainly between six and twelve years of age, the mental ratio was 86·7 and educational ratio 86·9 When a comparison was made between the average attendance at school of more than eighty of these children, the correlation coefficients between the percentage of attendances and the mental and educational ratios respectively were found to be the same, namely ·31. Thus the effect of physical defects is to reduce the intelligence quotient because it decreases the amount of schooling.

The canal-boat children attended school either little or not at all, but as far as health, cleanliness, morality, feeding and clothing are concerned their parents compared favourably with town dwellers of the same class. The average intelligence quotient for 76 of such children was found to be 69·6, which is only slightly higher than that for mentally defectives. But these children are by no means of the defective class. The clue to their poor performance in the tests lies in the fact that they are handicapped severely by their lack of educational opportunity, for the very youngest amongst them test normally. A startling fact was disclosed by com-

paring the children in the same family, namely that an increase of age is found to be associated with a decrease of intelligence quotient, shewing that the ability to cope with the tests depends on a scholastic frame of mind. Similar conclusions were suggested by the examination of gipsy children whose attendance at school is irregular, but more frequent than that of the canal-boat children. The mental ratio of sixty of the gipsies was 75·4 whilst their education ratio was 77·4; the correlation coefficient between average attendance and these ratios was ·37. As with the canal-boat children there was found a decrease of mental ratio with an increase of age, but not to the same extent, since they have more schooling.

Both Binet and Terman, agreeing in this respect with others, found that children of superior social status have a higher mental ratio than those of a lower status Thus, in the Stanford investigation the children were grouped into three classes, superior, average, and inferior; and it was found that the average ratio for the superior social group was 107 and for the inferior 93, which is "equivalent to a difference of one year in mental age with seven-year olds, and to a difference of two years with fourteen-year olds." Professor Terman attributes the difference, not however on very cogent grounds, to a superiority in heredity, i.e. to a better intellectual strain.

Further evidence was obtained by Burt in two schools in a London borough, one 'superior' the other 'poor,' at opposite ends of the social scale as compared with the general average of all schools in the borough. The children of the superior school turned out to be nearly a year ahead of the average in mental age, and the poor school were more than a year behind. From the known fact of the influence of school attainments on the Binet scale it is not surprising to learn that the preeminence of the superior school was more marked during the earlier years, sinking after the age of ten to about half its previous magnitude.

Messrs J. F. Duff and G. Thomson roughly classified the occupations of the parents of over 13,400 Northumberland children over eleven and under thirteen years of age, so as to shew differences of social standing, of skill and responsibility. They found that the average intelligence quotient was highest amongst the children of professional classes, namely 112·2, managers 110, and higher commercial classes 109·3, and lowest amongst the children of miners and quarrymen, namely 97 6, agriculturists, 97·6 and low grade labourers, 96·0. These results are not strictly comparable with the former since they were obtained by means of the Northumberland group tests, whose correlation with the Stanford revision is however high, i e. ·8. A rough classification into brain workers and hand workers shewed that the children of the former had an average quotient of 106 6 and the latter 98·6; the average of all the children being 99·6.[26]

A curious and illuminating fact has been brought to light by investigations in London schools, which seems to be in favour of the view that the differences in mental ratio, due to social status, are not the effects of nature but of nurture. The order of difficulty of the various items of the tests differs both for children of differing social grades and also for the sexes. There is a distinct parallelism between tests which are easier for girls and those which are easier for children of a better social class. One ground for the similarity lies in the partial similarity of environment, for girls are more supervised, sheltered and detained at home than boys; so that their external conditions tend to approximate to those of children in general of a higher social grade. It should be stated, however, that the variations in the order of the tests for differences of social status and sex are not very great in number or degree.

THE DISTRIBUTION OF INTELLIGENCE

Professor Terman had found that for over 900 unselected school children between the ages of five and fourteen years the distribution of intelligence, as measured by his revised scale, was very symmetrical. The actual figures were as follows, from which it will be seen that the frequency of the different grades decreases gradually, in both directions, from the median grade.

I Q	56–65	66–75	76–85	86–95	96–105	106–15	116–25	126–35	136–45
Percentage	33	2·3	8·6	20·1	33·9	23 1	9 0	2·3	·55

The symmetry of this table should be compared with that of the following figures for the distribution of ability, obtained by examining over 2,700 children by the Northumberland group test.

I Q	up to 60	61–70	71–80	81–90	91–100	101–10	111–20	121–30	131–40	140 and over
Percentage	·3	2·4	8·8	15·2	23·9	22·4	15 2	8·6	2·9	·3

Burt has treated the question of the distribution of intelligence at the ordinary elementary school age for London children very thoroughly. He combined the results of the percentages obtained at the different ages into a single frequency diagram, and compared this with the results which would have been obtained if intelligence were distributed in accordance with the 'normal curve' of frequency. His figures for ordinary children have been used to construct the diagram on the next page, where the normal curve is superimposed for purposes of comparison. He says that the figures, if they do not corroborate, do not in any way contradict, the hypothesis that ability is distributed in close conformity with the normal curve of frequency The asymmetry can be readily accounted for, by the absence of adequate tests for brighter children of the older ages.

The distributions, so far considered, are composite figures for children of various ages. A recent investigation [27] in Scotland provides us with a cross-section of the distribution of intelligence within a single year of age. A mental test appropriate for selecting children for scholarships was given to many thousands of children of the age of eleven years.

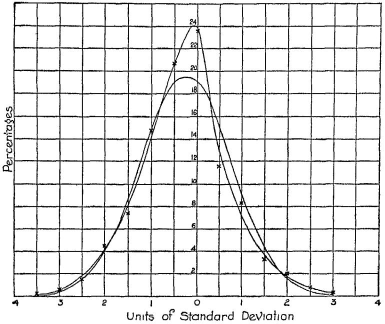


Diagram of Distribution of Intelligence drawn from numbers obtained by Burt The upper curve shews the actual distribution, the lower curve the theoretical percentages for a normally distributed group

From these, a random sample of 1,000, consisting of equal numbers of boys and girls was selected, yielding the following table.

I Q	129 +	110–29	90–109	70–89	70 —
Percentage	6·1	23·5	44 8	25·0	1·3

From Terman's table, given above, the standard deviation or 'scatter' of his 900 cases was found to be 13. In the

Scottish survey the standard deviation for boys was found to be 17 and for girls 16. In other words, girls are less scattered than boys at this particular age, though the average intelligence is the same. If we use these later figures, and assume that intelligence is distributed ' normally ' the following percentage result is obtained.

I Q .	130 +	110–30	90–110	70–90	70 –
Girls	3	24	46	24	3
Boys	4	24	44	24	4

If we assume, as is usually done, that an I Q. of 90 to 110 is ' average,' then somewhat less than half the pupils at eleven years of age are average The Scottish investigators formed the opinion that · " The wide variation of intelligence among children of the same age supports the modern tendency to adjust subjects and methods of instruction to the mental age of the child. It should heighten the expectation of what may be attained by the selected few, but should also damp the ardour of those who believe, without reliable evidence, that many of the group (more than 25 per cent) with I.Q.'s below 90 are able to do work which comes readily within the grasp of the average child."

GROUP TESTS

The tests originating with Binet are intended to be given by the examiner to individual subjects and to be accompanied by a report on the manner in which such subjects deal with the single tests. Up to the year 1917 such individual tests held the field, although sporadic attempts at testing groups of persons, simultaneously, by written tests had been made. In 1917 a committee of American psychologists met to produce a group examination in order to classify recruits for the army.[28] They examined the previous tests of both individual and collective varieties. A complete group test, the work of Mr A. S.

Otis, a member of the committee, existed in manuscript and was similar in form to that finally adopted for the army tests. It must always be remembered that a group test gives no indication of the numerous minute, but extremely valuable, indications of mentality which an individual test offers the examiner. Further, it is dangerous to apply a group test, outside very narrow limits, to other uses than that for which it has been prepared. Certain criteria determined the choice of the test adopted by the committee, and these may be classified as psychological and administrative. There are four psychological criteria and every group test should be constructed strictly in accordance with them. The tests should have a high degree of validity as a measure of intelligence, being compared in this respect with independent estimates obtained either from those who know the persons, or from individual tests. The range of difficulty must be wide enough to test higher and lower levels of intelligence so that "if 50 per cent of the group tested, or even 20 per cent, make zero scores, the test is unsatisfactory as a measure of a wide range of intelligence." Moreover, the test ought to be as completely independent of schooling and educational advantages as possible; a criterion hard to seek. Finally, the material used should arouse the interest of the examinees.

All the other criteria are purely administrative and are aimed at examining and correcting as rapidly as possible, eliminating personal bias in correcting answers, avoiding coaching, and demanding a minimum of writing in recording answers. Many enthusiastic testers appear to forget that these are all purely matters of convenience and have little psychological significance.

The committee selected a number of tests believed to have a high degree of validity as indicators of intelligence, and gave them to selected groups. On the basis of these trials ten were chosen, and given to a large variety of subjects in

the army, colleges, institutions for feeble-minded and so on. Each test consisted of separate items the number of which was so fixed that 5 per cent of individuals or less in any average group would be able to finish the entire series in the time allowed. This was in order to give the superior persons a fair chance; the inferiors were catered for by one or two sample items correctly answered and printed at the beginning of each test so as to act as shock absorbers, and all the items were set out in increasing order of difficulty. The tests were checked by comparing their results with those obtained from subjects who had previously been examined by individual tests, and by teachers' estimates and officers' ratings. Professor Thorndike checked the validity, reliability and significance of the tests by statistical methods. As a result of all this sifting eight tests were finally chosen and received the name of army *alpha* group tests. Another group test known as army *beta* group test was constructed for illiterates, who could not read English, and was " in effect, although not in strictness test for test, alpha translated into pictorial form." The tests were given to nearly one and three-quarter million men, but as the scoring and interpretation was entirely in terms of military needs it is dangerous to generalise the results. Even in their own sphere it was stated that " there are convincing evidences that some men are not fairly measured by either alpha or beta tests and that the provision of careful individual examination " is necessary in such cases. The reliability coefficient was ·95, and the correlation coefficient with Stanford-Binet tests was from ·8 to ·9 for adults; for American school children the coefficient of the alpha tests compared with teachers' estimates turned out to be from ·67 to ·82. An application of these tests to seventy English grammar school boys in the fourth and fifth forms [29] yielded a coefficient of ·48 when compared with their ranks in school subjects When compared with the marks obtained in the

school certificate examination of a University the correlation was 60.

Group tests have been widely employed in many countries for educational purposes in order to gauge differences in average intelligence in different schools and areas; and in England have been most frequently used to pick out children from the elementary schools capable of profiting by a secondary education In almost every case they have been employed as a supplement to the ordinary scholastic examination and are not intended to replace the latter Where the children in small country schools are deprived of the educational advantages enjoyed by urban children, group tests are most valuable in redressing the balance. Professor G. H. Thomson has designed a useful test with this object in view, known as the Northumberland mental test.[30] He prepared several tests including some examples used in the *alpha* series and devised certain new ones. These were tried on about fourteen hundred school children from ten and a half to thirteen and a half years of age in different parts of the country, and thereby the unsuitable tests were discarded Six types of suitable examples survived. The test lasts for one hour, and speed is eliminated, as practically all children tested can finish all they can do in an hour. A couple of typical examples are shewn worked out in the printed tests, and, on the day before the test is set, a ten-minute practice-test is given as a safeguard against stupor pædagogicus. It has been found that pupils thoroughly enjoy the tests, so that in this respect as in the others, the criteria above enumerated were satisfied In the preliminary investigations it appeared that the rural districts gave results which were more than a year behind those of a large city; consequently, when the tests are to be used in any area it is as well to use scores derived from the results in the same area Generalisation in group tests is always hazardous, and as far as possible the scores of each group should be used

to measure the individuals within the group. A group of fifty children whose mental ratio was determined both by the Stanford-Binet tests and by the Northumberland tests yielded a correlation coefficient of about ·8

A large number of other group tests have been devised and used, but as no psychological principles are involved in their construction, or use, other than those considered above, it is unnecessary to enter into details in this book. The student will find a bright account of a number of such tests in *Group Tests of Intelligence* by Dr Ballard.[31] Strenuous attempts have been made in America to devise group tests suitable for testing candidates for college. Professor Thorndike has constructed a group test of a composite form involving many of the *alpha* type together with absurdity tests, reasoning tests and others, and also scholastic tests, the whole taking two and a half hours. This battery was fired off at two hundred and fifty women students of average age eighteen and a half years on entering college and again each year in succession till they graduated.[32] As part of their normal procedure these unfortunate students were pestered thirty times with various college examinations during their undergraduate course. There were one hundred and fifty who survived The correlation coefficients for the survivors between the marks in the academic examinations and the tests are shewn below.

Year	1	2	3	4
Pearson coefficient .	·56	·43	·36	·38

It is usually accepted by experimenters, although no proof is forthcoming, that such tests to be considered satisfactory should have a correlation coefficient with ordinary examination marks lying between the limits of ·40 and ·60.

The mean correlation coefficient of the academic marks alone for the four years was ·68, and this figure may therefore be taken to be the highest which could be expected with the

tests, since one sample of academic achievement could not, save by chance, agree more closely with a measure of intellectual ability than with another sample of itself. The decrease in the amount of correlation in the successive years was explained by the fact that the group became more homogeneous academically, owing to the elimination of those who could not tolerate the examinations. The conclusion reached by the investigator was that, although the tests can forecast a student's success in college as accurately as school records or college entrance examinations, yet they cannot be used alone to predict academic success but supply useful supplementary information in doubtful cases.

From time to time attempts have been made to compare the various kinds of group tests with one another. One such comparison was recently made with five group scales, including the Northumberland variety, which were given to about three hundred English children between the ages of ten to fourteen years in elementary schools and a girls' boarding school.[33] The average coefficient of correlation of all the five scales with the examination marks in ordinary school subjects turned out to be ·46, whilst an independent comparison with the teachers' estimates of the intelligence of the pupils yielded an average correlation coefficient of 30 The different scales, correlated among themselves, produced high coefficients ranging from 88 to ·70, and the experimenter inferred that the various scales measure much the same thing.

Possibly they may, since many group tests are constructed more or less after the manner of alpha tests, with variations; but the assumption must be treated with caution A coefficient of correlation, obtained from large numbers, may obscure individual differences. Thus two different group tests were given by the same person to 120 school children [34] and the correlation coefficient by the rank difference method was ·64; but six pupils changed rank more than 60 places whilst the

median change of rank from one test to the other was 18 places. It was observed that "if these 120 pupils had been divided on the basis of the intelligence scores of one test into 4 class sections of ordinary size, 52 per cent of them would have been in the wrong section according to the other test." As two forms of the same test usually yield very high correlation coefficients, sometimes well over ·9, the investigator doubted whether the group tests, "though called general intelligence tests, are really measuring the same element in the pupils' endowment"

Examples of individual and group tests are given at the end of the chapter. There are a large variety of other tests, including performance tests involving no use of language, but the manipulation of pictures, models, etc. These will be dealt with in the next chapter. In addition, there are vocational and scholastic tests.[85] Certain other tests have been devised, such as tests of æsthetic appreciation of various arts. When these are sufficiently developed they may come into general use, and in fact they have already been successfully applied. The complexity of artistic perception and the violent fluctuations of taste at different periods introduce a serious but not an insuperable difficulty. For judgments of artistic value are made by most people, for some forms of art, and, if it is possible to say that one work of art is better than another, it is not beyond the range of possibility to assess such judgments.

SOME OBJECTIONS

F. In addition to the various criticisms that have been incidentally made up to this point, there are some further objections which have been raised to mental tests which must now be briefly considered. A game can only be played

properly when the players agree, explicitly or tacitly, to abide by the same rules, which agreement gives a certain 'set' of mind. In giving a mental test the experimenter takes for granted that the person will assume this attitude of 'make-believe.' But a bright child may resent this attitude and refuse to adopt it, when an incorrect answer from the examiner's point of view may only mean that the child has adopted some other supposition. The universe of discourse, within which the examiner expects his reply, may not be the universe which the child is exploring It may also happen that bright children regard the questions as ridiculous (which they often are) and the procedure as silly (which it sometimes is) and so refuse to play this particular game. Group tests as opposed to individual tests cannot take into account this incalculable factor, and it is always assumed that the ability to make the examiner's assumptions is an essential part of intelligence. In one good group test [36] the following examples, chosen at random, occur. "What do we tell people the truth to save them from being? *Angry? Excited? Deceived? Unhappy?*" A child who told his parents an untruth might make them angry, excited and unhappy without deceiving them. Which of these four replies is an unfortunate youthful casuist to select? "Stamps are put on—*tables? letters? pictures? trees?*" Everybody knows that tables are sometimes stamped in public places, pictures in library books nearly always are spoilt in that way, and I have seen trees stamped in forests to indicate the route. Which is the correct reply to choose? In an individual test the answer could be checked, if necessary.

Experimenters always claim that they get into friendly and intimate relations with the pupils when giving individual tests, but it may well be doubted whether this is possible in the time necessary to administer the Binet tests, except by those who have a natural *flair* for dealing with children and

adolescents. Moreover the necessity of adhering, more or less, to rigid formulæ, which is the condition for making comparative observations, may militate against the exploration of a child's powers, and leads to examination stupor. This was well brought out by the Danish psychologist, W Rasmussen,[37] who tried the tests on his own daughters, and found that they were far too easy for children brought up in freedom in a highly cultivated home. He treated the whole thing as a game, and got replies which he regarded, rightly, as signs of intelligence, though they would have been rejected by a mental tester as not in accordance with the standard answers. There is for, instance, a test in the eighth year series in which a child is asked to count backwards from 20 to 1, and he gave this to one of his daughters of 5 years 8 months. When she got into difficulties at the number thirteen he heard her begin to count *forward* under her breath and he considered this ' an excellent proof of intelligence, the method of procedure being improvised on the spur of the moment, entirely on her own initiative.' But no mental tester would pass this, as he would consider it not playing the game, so the child who does it may be considered to that extent to lack intelligence, unless great care is taken.

Another objection against the tests was urged by the late Professor J. A. Green.[38] He pointed out that intelligence is correlative to the universe in which it works, it does not work *in vacuo*: thus a dog may be a very intelligent animal within its own universe of action. As the universe expands so the intelligence grows ; hence, when a man does no better than a boy in a given set of tests, this does not mean that they have the same intelligence, since if we wish to give a test to both it must obviously be within the universe of the boy's capacity; otherwise we would have no means of comparison. This may be put more generally thus : if we have two individuals A and B we have two universes to consider *a*

and *b*. If the mental efficiency of A in universe *a* is *x* and that of B in *b* is *y* we cannot compare the efficiency of A and B until we know the relative complexity of the two universes. But this objection, forcible as it is, can be overcome if the tests are marked on an absolute scale, for there is a considerable amount of overlapping between the two universes. All these criticisms, though important, do not fundamentally impair the value of mental tests. If we wish to compare different people we must adopt some standard of comparison. The criticisms indicate the kind of precautions that an experienced examiner will bear in mind, and also call attention to the danger of allowing the tests to be used by those who are not practical psychologists. A certain amount of rigidity in the use of the tests, and adequate standardisation are essential for comparative purposes. Nevertheless, a psychologist with insight will make the necessary adjustments in assessing any particular individual.

Dr Burt considers that for normal children the Binet-Simon tests yield the most accurate measurements at the ages of 6, 7 and 8 years The following are therefore given as samples of the London Revision in average order of difficulty

Age VI

(Children aged 5 to 6 should do half the following in addition to previous tests)

1 Knows (without counting) number of fingers on right hand, left hand, both hands.
2 Counts 13 pennies.
3 Copies a large diamond shape ($2\frac{1}{2} \times 1\frac{1}{2}$ inches) recognisably.
4 Copies legibly from script. "See little Paul."
5 Names days of week without error in 10 seconds.
6 Names without error 4 coins, 1s, 1d, 6d, ½d
7 A visiting-card ($2\frac{1}{2} \times 3\frac{1}{2}$ inches) is cut in two diagonally. The triangles are placed so that the hypotenuses are at right angles The child fits them together properly
8 Defines by stating their use 3 out of 5 of the following: horse, chair, mother, table, fork.
9 Repeats 5 numbers (1 trial correct out of 3) 52947...... 63852 . ...97318.
10 Describes items in 2 out of 3 prescribed pictures
11 Repeats after the examiner the following. "We are going for a walk, will you give me that pretty bonnet?"
12 Shews his (*a*) right hand, (*b*) left ear

Age VII

(Children aged 6 to 7 should do half the following)

1 Recognises missing features (3 out of 4); (*a*) man's head—mouth missing, (*b*) woman's head—eye missing; (*c*) woman's head—nose missing; (*d*) woman with missing arms
2 Adds without error 3 pennies and 3 half pence (in 15 secs.).
3 States difference between (2 out of 3 in 2 mts.): (*a*) fly—butterfly; (*b*) wood—glass; (*c*) paper—cardboard.
4 Writes legibly from dictation, "The pretty little girls."

AGE VIII

(Children aged 7 to 8 should do half the following.)

1 Reads, without assistance, a prescribed passage enumerating 20 items and recalls 2 items out of the 20.
2 Answers the following questions (2 out of 3) What would you do—(*a*) if missed train. . , (*b*) if broke something belonging to somebody else . , (*c*) if struck accidentally by boy or girl ?
3 Counts backwards from 20 to 1 (in about 30 secs with only one mistake)
4 Gives full date Day of week . Day of month. . (3 days' error allowed) . month . . . year.
5 Gives change for 2d out of 1s (from the following ¼d , ½d., 1d , 6d , 2s , 2s 6d , 10s , £1)
6 Repeats 6 numbers (1 trial correct out of 3) · 250364 . . . 853916. . . . . 471582.

SAMPLES OF GROUP TESTS

The following are samples from the *alpha* tests, the first and last item being selected in every case. In all the tests except the first, one or more items are solved as a guide

Test 1 Directions (12 items).

(*a*) Look at the circles (5 circles of 1 cm. diameter side by side are drawn).
Make a cross in the first circle and also a figure 1 in the third

(*b*) Look at 12 (the figures 1 to 9 printed in bold type)
If 7 is more than 5, then cross out the number 6 unless 6 is more than 8 in which case draw a line *under* the number

Test 2 Arithmetical problems (20 items)

(*a*) How many are 30 men and 7 men ?
(*b*) A commission house which had already supplied 1897 barrels of apples to a cantonment delivered the remainder of its stock to 29 mess halls. Of this remainder each mess hall received 54 barrels. What was the total number of barrels supplied ?

Test 3 Practical judgment (16 items)

Make a cross before the best answer

(*a*) Cats are useful animals, because
— they catch mice,
— they are gentle,
— they are afraid of dogs.

(b) Why is it colder nearer the poles than nearer the equator? because
— the poles are always farther from the sun
— the sunshine falls obliquely at the poles
— there is more ice at the poles.

Test 4 Synonyms and Antonyms (40 items).

If two words of a pair mean the same or nearly the same, draw a line under *same* If they mean the opposite or nearly the opposite, draw a line under *opposite* If you cannot be sure, guess.

(a) wet—dry same—opposite.
(b) encomium—eulogy same—opposite

Test 5 Disarranged sentences (24 items)

Below are some mixed sentences Some of the sentences are false and some true. Think what each *would* say if the words were straightened out, but don't write them yourself. If what it *would* say is true, draw a line under the word " true ", if what it *would* say is false, draw a line under the word " false." If you cannot be sure, guess.

(a) lions strong are true—false.
(b) repeated call human for courtesies associations true—false.

Test 6 Number Completion Series (20 items)

Look at each row of numbers below, and write the two numbers that should come next.

(a) 3 4 5 6 7 8 . . . . .
(b) 3 6 8 16 18 36 . . . .

Test 7 Analogies (40 items).

In each line, below, the first two words are related to each other in some way. What you are to do is to see what the relation is between the first two words, and underline the word in heavy type that is related in the same way to the third word

(a) gun—shoots : · knife—RUN CUTS HAT BIRD
(b) cold—ice . . heat—LIGHTNING WARM STEAM COAT

The following are samples of novel tests used in the NORTHUMBERLAND tests. They are selected from the easier or shorter examples.

Extra word.

1 The pupil is required to underline the *extra* word.

Example : wood, cork, stone, boat, bladder—stone because the others float.
grapes, wool, oranges, apple, banana.

Schema.

2 The following schema is explained and two relationships are solved as a guide

Mr and Mrs Adams

Thomas Hawthorn = Ethel   Mabel   James = Bridget   Mortimer

Timothy   Edward   Elizabeth

The pupil answers these questions (*a*) What is Timothy's surname ?
(*b*) Elizabeth's surname ?
(*c*) Who is Timothy's uncle ?

Middle word

3 The pupil has to arrange *mentally* the five words in each line in their proper order and underline the middle word

Example. minute second year hour week
elephant sheep mouse cow puppy

Hindustani Test

4 The sentences below are in a foreign language and their meanings are given in English In each English sentence a word is underlined and you have to underline the word which corresponds to it in the foreign sentence.

1 Kuch malai	some cream
2. Kuch puri leoge	will you take some cake ?
3 Misri leoge	will you take sugar ?

This example is worked out fully and two more difficult examples are set

Professor Thorndike has selected a series of four tasks, which he regards as suitable for measuring intelligence at all levels, from the mental age of three up to the mental age attained by the top quarter of college graduates. They consist of (C) supplying words to make statements true and sensible, i.e. completion tests, (A) arithmetical problems, (V) understanding single words (vocabulary), and (D) understanding connected discourse. This selection of C A V D tasks correlates highly with any other set of mental tests and the following are samples of some of the most difficult, suitable for testing the highest levels.

(C) Write words on the dotted lines so as to make the whole sentence true and sensible

It must . ...seem to the wisest. .. ..men, when brought into contact with the great things of nature that . . . . they . . ..is. . . .. . nothing to the infinitude of . they are ignorant.

(A) Let A.D = the average of the deviations of a set of numbers from their average, disregarding the signs of the deviations Find the A D. of 6, 9, 10, 11, 14

(V) Look at the first word in the following lines. Find the other word which means the same or nearly the same, and write its number at the side of the page

Sequestiate (1) follow (2) petition (3) horseman (4) confiscate (5) redwood

(W) In each set of sentences, check the two which mean most nearly the same as the first ·

Shew me the man you honour I know by that symptom better than any other, what you are yourself

(Carlyle)

— — A man is known by the company he keeps

— — Tell me what you've done and I will tell you what you are

— — A man is known by his idols

— — Shew me your chips and I will tell you whether you are a good woodsman.

In recent tests there is a tendency to mix the various items, instead of putting the like ones together. The following are some random samples of the test for the NATIONAL SURVEY OF SCOTTISH CHILDREN at the age of 11 years

(1) If 19*d* is the same as 1*s*.—7*d*. write G, if not write R .. ..( )

(2) Write the letter that comes most often in Constantinople.......... . ( )

(3) Fill in the number which has been left out in the top line of this addition sum, and write it in the bracket as well . .. .( )

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 3 . 2
1 7 6 6
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2 1 1 8
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(4) If G is found before J in the alphabet and R is found before L, write S. But if only one of these is true write P. . .....( )

(5) Look at these three proverbs. Two of them mean nearly the same. Put a cross plainly after the other one :

Well begun is half done.
It's the first step that counts.
Waste not want not.

(6) If the letter A occurs more often than any other in the word CANADA write the middle letter of the word SLEEP unless P and R come next to one another in the alphabet, in which case write Y instead . .. .( )

(7) In a certain secret writing

l z q k c o f u, f t t r y g g r means
S T A R V I N G, N E E D F O O D

In the same writing you find this. Write below what it means.

y o c t k g c t l r t q r

(8) The next question is in the same secret writing. Write down what it means *and answer it.* You can get most of the letters from (7) but there are some letters you will have to guess

o l z g r q n D g f r q n ? ... .(

Answer ....(

(9) Three posts are at the corners of an equilateral, that is an equal-sided triangle From where I am standing a long way off, the post nearest to me seems to be exactly half-way between the other two If I now take two side steps to the left, will the posts look like this I II ?

or like this II I ?

Mark the right one with a tick

(10) If I am facing the west with my arms stretched out sideways, in what direction is my left arm pointing ?......... . ..( )

CHAPTER XIII

MENTAL TESTS—II

Meaning of Intelligence—Principles of Cognition—Tetrad Equations—Performance Tests—Child Guidance—Vocational Guidance

THE MEANING OF INTELLIGENCE

HAVING sketched the origin and development of mental tests it is now time to consider, more in detail, what it is that the tests measure. It is widely assumed that the ability to make a good score in mental tests is a sign of a high degree of intelligence, and for this reason the tests are more frequently called intelligence tests. But there is no agreement as to the nature of intelligence; and those who use the tests successfully to solve certain practical problems, such as the determination of mental deficiency, or the picking out of bright pupils for more advanced education, hold the most divergent views on the subject.[1] Some, indeed, consider that it is not necessary to have any definite view, but that the tests may be employed to measure intelligence even if we are completely ignorant of its nature. Intelligence is, according to this belief, simply a hypothetical concept or working hypothesis, which is helpful in practical work, and about which it is not essential to have any definite theory It is held that it is frequently feasible to make practical use of a concept when its nature is completely unknown, just as it is practicable to use and measure energy from an electrical

source of supply, though neither the nature of energy nor electricity can be defined by the user. But the analogy is not completely satisfactory, for we could not measure an electric current unless we were sure that the measuring instrument was in circuit with the current When a mental test is employed, what guarantee have we that the test is in circuit with the intellectual current? And, if this assurance could be obtained, we should still suspect that it was also in circuit with some other capacities of a non-intellectual kind.

Psychological analysis has long since destroyed the belief in such conceptions as simple desire, unalloyed feelings, pure reason and similar notions; and it is now generally held that all normal mental states have three aspects, the cognitive, affective, and conative. This should make as suspect that the notion of pure intelligence is a pure abstraction. Such qualities as mental balance, control, steady purpose, etc. are all implicated in the concept of intelligence, and these are mainly conative activities Again, a person's emotional attitude and his temperamental qualities are inextricably interwoven with his intelligence. In all mental testing, such affective and conative data should be taken into account, by consulting teachers and others, who have had prolonged intercourse with the individuals tested. Some of these difficulties had been foreseen by Binet and Simon in constructing their 'barometric scale of intelligence.' They pointed out that to succeed in school work demands will, character, docility, regular habits and especially continuity of effort. But, they were of opinion that these factors were so little called into play in the tests, that intelligence could be sharply distinguished from scholastic ability. In this belief they were undoubtedly mistaken, and although Binet regarded intelligence as being displayed by suitable adaptation to the environment, and was aware that scholastic attainments influenced the tests, he failed to see that a dominating part

of the environment of a child was the school and scholastic traditions.

An epigrammatic view of intelligence is given in the definition that intelligence is the capacity to acquire capacity. Indeed, it would be strange were it not so, for whatever view may be taken of the nature of intelligence, our only means of getting into contact with it is by its performances. For intelligence, properly considered, is concerned with problems, theoretical or practical, suppositions and propositions, i e. with meanings sought or discovered. An individual may be said to have intelligence in so far as he is able to adapt his actions and thought to the meanings, obvious or implied, in his physical or social environment. Mental tests assume that the persons examined have had the normal opportunities of learning. A certain amount of knowledge is presupposed; and those are not far out who assume that a properly constructed examination in scholastic subjects, is, whatever else it may be, a test of intelligence. And in the last chapter we saw reason to think that the Binet tests depended on school attainments at least as much as on other factors. The ability to excel in scholastic work, in so far as it does not depend on the capacity to memorise alone, is an indication of a pupil's capacity to acquire capacity. The acquired capacity may be of a practical rather than a theoretical nature; and for such practical intelligence neither ordinary school work nor verbal mental tests are adequate criteria. For testing such intelligence various so called performance tests have been devised, which we shall consider later.

Still, such considerations do not yield an answer to the question of the nature of intelligence. In despair of any answer, some have gone so far as to maintain that to talk of intelligence is merely to hypostatise a general name. That is to say, whilst there are intelligent processes and acts there is

no reason to assume an entity called General Intelligence, but that this is simply a class name for the totality of all such acts. Before assenting to any such conclusion it will be instructive to consider the views of Professor C. Spearman as set forth in his two books, *The Nature of Intelligence* and *Abilities of Man*, which must be studied by all who wish to get a sound philosophical view of this difficult subject. He divides all theories of intelligence into three classes, the unifocal, the multi-focal and the non-focal, more picturesquely described as the monarchic, the oligarchic and the anarchic theories respectively.

According to the unifocal view there is one ruling power or ability, which holds sway over all man's capacities, an entity called intelligence Whatever mental process is performed it is guided in its activities by this entity, and so exhibits its character, just as the executive acts in a monarchy are carried out in the king's name. But, as soon as we ask what are the differentiating characters of this supreme authority, all definiteness vanishes Some define this authority as ' conscious adaptations to new situations '; a very popular definition of intelligence in the early days of mental testing. But this does not carry us very far, since any reaction whatever to a situation is an adaptation to it. And if we were to qualify the statement, by saying that the adaptation must be appropriate or correct, that would be simply saying that it must be intelligent, so that we should be talking in a circle. A different view of the nature of the supreme authority was held by Professor Ebbinghaus, who regarded intelligence as being displayed in the power of synthesis, i.e. the capacity to bring together a multitude of independent impressions into a unitary whole. An unintelligent person cannot see the wood for the trees, whereas the intelligent person can perceive certain general features of the situation and, by getting an insight into their relations, view the situation as a whole,

In earlier chapters of this book we studied this power of insight into the meaning of configurations as a whole, and concluded that this was the normal process of mental development. We also saw, however, that it was a mistake to suppose that the elements of a configuration were initially apprehended separately, and subsequently synthesised. Intellectual insight is, on the contrary, comparable with the development of a living organism, in which the various organs become more definitely marked out from a relatively undifferentiated mass of cells, as the fertilised ovum gradually segregates and develops.

The final unifocal view, that we shall touch upon, is one which dates back to scholastic philosophy, and is still considered by many to mark out the essential feature of intelligence. An intelligent person is regarded as an individual who is able to carry on abstract thinking, this being the kernel of all reasoning. The scholastics were interested in logic, especially in its formal aspects; and distinguished the three processes of conception, judgment and reasoning as the ultimate logical processes These processes constituted the operation of thinking in abstract or universal terms, as opposed to the process of sense-perception which was concerned with concrete things Such a division is, no doubt, valuable for logical theory, since logic deals with symbolism. But, from the psychological standpoint the distinction is artificial, since an intelligent process may be carried out in concrete as well as in abstract terms, and we cannot separate the two. Yet we may agree that the ability to ignore the sensory elements in a situation, and fix attention on the underlying meaning is an indication of intellectual capacity.

We may now pass on to the multi-focal view of the nature of intelligence. According to this theory there are a few outstanding powers or capacities, such as invention, reasoning, judgment, etc., which are called into play in a lesser or

greater degree, by any series of tests which can be properly called intelligence tests. Each of these capacities would have to be measured separately, and the score for each would indicate the degree of development attained in it. A somewhat different version of the multi-focal theory rests on the belief that, the ability to cope with a mental test depends on the particular mental level to which it appeals, such as the perceptual, the ideational, the rational, etc Two mental tests will be positively correlated, on this theory, according as they call into action powers at the same level, and an intelligence test would have to provide sub-tests at each level. As Professor Spearman has pointed out, this theory of separate capacities or levels is the modern form of the faculty theory of psychology, and is therefore subject to all the objections which have made that theory untenable, which were considered in our first chapter. This multi-focal theory must not be confused with the multiple factor theory.

The non-focal theory does not boggle at faculties, but, on the contrary, is willing to admit a considerable number of them; all highly particularised and independent of each other. These, however, are not the complicated traits or powers of the old faculty psychology, but elemental capacities of so primitive a kind that we need not cavil at them. The theory is, therefore, called the multiple factor theory, under which title we shall consider it, in detail, later. Any specific mental test is said to call into play a varying number of such elemental factors or abilities. Professor Godfrey Thomson's " Sampling theory of ability " is a most developed mathematical of this non-focal view.[2] According to him, there are a group of independent abilities involved in carrying out any mental test; such a group being but a sample of the whole array of elemental abilities which the person possesses. Excellence in any mental test, other things being equal, would depend on good team work, that is a group of such

primitive abilities acting together as one unit. On this view, the answer to the question, as to the nature of intelligence, is that it consists in a well-developed organisation. It is obvious that without some degree of mental organisation there could be no mental ability of any kind And it will be readily agreed, that what we are trying to discover by a mental test, is the degree of development, and the extent of organisation, of the cognitive processes, in so far as it is possible to deal with these apart from the matrix of other processes within which they operate. For this reason we shall next consider cognitive processes as a whole, and deal with their organisation later.

But a warning must be given at this point, which is frequently overlooked. It is not abilities, elemental or otherwise, which accomplish anything, but the person who has the abilities The subject-object relation is fundamental in psychology. In other words, every psychological process is an attribute of some subject or person. In considering the theory of mental testing we may ignore one side of this relation, and confine our attention to the objective side alone, i.e. to the test results; but sooner or later we must bring the subject again into the picture. That wise physician Dr J Arbuthnot (d. 1735) wrote:

> "This frame, compacted with transcendent skill
> Of moving joints obedient to my will,
> Nurs'd from the fruitful glebe, like yonder tree,
> Waxes and wastes; I call it mine, not me."

THE PRINCIPLES OF COGNITION

One of the numerous debts which the theory of mental testing owes to Professor Spearman is the investigation of the principles of cognition. Other workers, in the field of testing, had limited themselves to the construction or the

analysis of tests, but he was the first to take a comprehensive survey, by providing a philosophical background against which to evaluate any test. The nature of intelligence can only be adequately discussed when the principles of cognition have been set forth; for whatever else intelligence may comprise, it is undoubtedly primarily a cognitive function. According to Professor Spearman's acute analysis there are three such principles. They are all said to be self-evident, and as they deal with intellectual processes they are described as *noetic*. But, since they are also concerned with the generation of new items of experience, from those which are already given, they are called *noegenetic* principles

The first of these principles is formulated thus: 'Any lived experience tends to evoke immediately a knowing of its characters and experiencer.' The last phrase in the statement is meant to indicate that, whenever a person has any experience, he is not only aware of it, but, also is aware of himself. In other words, every conscious process is, also, to some extent, self-conscious Thus when I feel warm, I am aware not only of the warmth, but of myself as feeling warm; when I experience an emotion, in addition to being stirred, I am aware of myself as being affected. There is no doubt that, in human experience, some such process occurs at all levels; since otherwise it would be impossible to account for the fully developed self-consciousness of later life. When a child begins to use the personal pronoun, I, his self-consciousness is well under weigh, and must have had its roots in his past experience.

With regard to the first part of the principle the matter is not quite so clear. It is not certain that all experience can be introspected, which is the apparent implication of the principle that experience tends to provoke 'a knowing of its characters' Many subconscious processes occur without any possibility of introspecting, and so analysing them. Thus, an

unmusical person may be able to distinguish a piano note from a violin note, but completely unable to say in what the difference consists. Again, complex emotions have always been experienced, but it is only in recent years that psychologists have made an attempt to introspect them, and have not yet reached agreement as to their analysis Similarly, all of us may meet the same people frequently but find it impossible to describe, for example, the colour of their complexion. Part of artistic training consists in making the pupil aware of colours and forms which he has seen all his life but not discriminated. Unless, therefore, we strongly emphasise the word *tends*, in the statement of the first principle, it must be accepted with great caution, and may not be true of all subconscious cognitive experiences

The second principle, known as the eduction of relations, is stated as follows : 'The mentally presenting of any two or more characters tends to evoke immediately a knowing of relations between them.' Any of the tests of the analogies type illustrates this principle in a straightforward way, e.g.

retina is to *eye* as *aerial* is to . . .

Here the two characters or fundaments presented are *retina* and *eye*, and before the test can be completed it is necessary to discern the exact relation implied. Of course, there are many other relations between these two fundaments, but the third fundament, *aerial*, specifies a relation of a particular sort. It is necessary to bear in mind that when relations have been discerned, these may become the fundaments for further relations, and so on indefinitely This is the foundation of much mathematical reasoning, for the relations between certain symbols are themselves symbolised and thereafter become the foundation for further relations.

The third principle, the eduction of correlates, states that, 'The presenting of any character together with any

relation tends to evoke immediately a knowing of the correlative character.' This may also be illustrated by the example given above. For, having discerned that the relation between the fundaments *retina* and *eye* is that part of the eye is sensitive to waves, this relation, together with the fundament *aerial*, evokes the fundament *wireless set*. Any number series illustrates the same principle, e g. given the series 2, 4, 8, 16, 32 . . . it is obvious that the relation between these fundaments is that of a geometric progression, and, therefore, the succeeding fundaments are determined

It is maintained by Professor Spearman that the value of a test, as a test of intelligence, rests on the extent to which these noegenetic principles are called into play; namely the introspection of experiences, the eduction of relations and the eduction of correlates.[3] Any specific test will, of course, depend not only on noegenetic processes, but also on those of a very different kind, such as sensory processes and the power of retention or memory, etc. But the diagnostic importance of a test, as indicating intelligence, does not rest on these latter processes, but solely on the former. This opinion, however, has been challenged by Professor Thorndike who asserts that intelligence is also displayed by such processes as analysis, synthesis and organisation of experiences. This is a matter of such fundamental importance for the theory and practice of mental testing that we shall examine it more fully later. In order to be able to do so we must first consider the analysis of the scores obtained in any given mental test. By this means we may also hope to get further insight into the meaning of intelligence

THE TETRAD EQUATIONS

It is desirable, before proceeding to this analysis, to clear our ideas as to the meaning of correlation, a term which we

have had frequent occasion to use. Two quantities are said to be correlated when there is a concomitant variation between them. Thus, for example, the intensity of illumination of the surface of paper on which I write varies concomitantly with the intensity of the source of illumination. The precise degree of correlation can, in many cases, be calculated. Thus, suppose a group of persons are given two different tests and the average marks obtained by the group, in each test, is calculated. If the two performances are perfectly correlated, then any individual who is above or below the average in one test will be, correspondingly, above or below the mean in the other. If the performances are completely uncorrelated, there will be no correspondence at all in the various individual deviations, above or below the mean, in both tests; but such deviations will be scattered by chance. When there is some, but not complete, correspondence in the deviations on both sides of the mean value, there is some correlation between the two abilities. If all the individuals, who are above the mean in one test, are correspondingly below the mean in the other, the correlation is inverse. A figure can be calculated, called the correlation coefficient, which is a mathematical function of the deviations from the means in the two performances; and this figure may range from 0 to 1, representing the extremes from no correlation to complete correlation. For complete inverse correlation the coefficient is —1. But any such figure may be a chance result, due to taking an unrepresentative group of persons; and to ensure that the result is not due to chance it is customary to compare the figure with its 'probable error.' If the coefficient is, at least, three times its probable error it is considered to be significant. It is an advantage to test the persons a second time, so as to guard against disturbing conditions and random errors. From the combined results of the earlier and later tests we can correct the coefficient and eliminate such random errors.

The symbol used to express a correlation coefficient is r, and subscripts are employed, thus r_{xy} indicates the degree of correlation between two tests x and y.

The formula for calculating the correlation coefficient is

$$r_{xy} = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}}$$

where x and y are the amounts of the deviations, for any individual, from the means of the group, in each of the two tests, and Σ the summation sign. If there is complete correlation, deviations from the mean in one test will be proportional to those in the other, i.e. $x = ky$; and by simple substitution in the above formula we get unity for the value of r. If there is no correlation, the corresponding deviations x and y will be scattered at random, both their signs and their amounts being chance results. For a sufficiently large group, Σxy will consequently vanish; giving zero for the value of r. Between these extremes fractional values can be calculated from the formula. Having obtained the value of r the probable error is given by the expression

$$6745 \frac{1 - r^2}{\sqrt{n}}$$

This method of correlation has been widely employed by Professor Spearman and his pupils to make a thorough investigation, not only of various tests, but of the mental processes underlying them, with the result that their researches have placed the theory of mental testing on a sound scientific basis. We may use this method to examine the 'Two Factor' theory of intelligence, which has emerged from these researches, and is closely related to the unifocal view, previously considered According to this theory, it is maintained that the performances of any individual in any branch of intellectual activity, such as mental tests, depend on a general factor g entering into all of them, and a specific factor s

peculiar to each activity, and further that there are no common or group factors involved, unless the activities are very similar. The general factor is independent of the specific factors, and these are independent of each other. The nature of the argument, which is believed to necessitate the existence of the general factor, has been stated lucidly by Professor C. Burt in the following manner Suppose we consider a series of different intellectual functions which we may call A, B, C, D, E, and "let us for illustration assume that these are specific manifestations of one common process, more or less essential to them all, and therefore connected with them in various degrees; then if A correlate with C, D, etc., in progressively diminishing degrees in that order, any other function of the same series such as B will also correlate with C, D, etc. in progressively diminishing degrees in the same order and similarly if the correlation of C with A be higher than C with B then the correlation of D with A will also be higher than that of D with B; so of E and similarly through the series in either direction." Now varieties of mental, scholastic and other intellectual tests have been given to the same groups of persons, and the correlation between them calculated. It is found, in all such cases, that the coefficients of correlation are as a rule positive, and frequently high, and whilst they are sometimes low they are only very rarely negative. Correlations between the tests are in fact found to exist, not only where the form of the tests is the same, whilst the subject matter differs, but even where both form and subject matter differ. These coefficients may be arranged in a matrix, or table in rows and columns, so that, on the whole, each is greater than any other to the right of it in the same row, or below it in the same column; and the magnitudes of the correlation *tend* to follow the rule stated above.

MATRIX OF
INTERCORRELATIONS BETWEEN SOME OF THE SUB-TESTS OF THE ARMY ALPHA TEST GIVEN TO 1,047 MEN

Test	*A*	*B*	*C*	*D*	*E*	*F*
A Directions		730	710	·686	680	·670
B Arithmetic	730		·791	763	·773	·736
C Synonym-Antonym	710	791		·834	681	·730
D Disarranged Sentences	686	763	834		·674	778
E Number Series . .	·680	·773	681	·674		704
F Analogies . . .	670	736	730	·778	704	

This system of correlations between each possible pair of tests in such a series is called a hierarchy. In the early period of the working out of the two-factor theory the criterion of perfection of the hierarchical order was said to be the perfect correlation between any two columns in the matrix or table. But this criterion has now given way to the tetrad equation, which is more fundamental. On the adequacy of this later criterion the validity of the theory rests. It must be said, at once, that whether the criterion is valid or not, the method of analysing test results by the use of the tetrad equation has proved of incalculable value in every sort of mental testing.

We shall now indicate the nature of the method [4] by which Professor Spearman proves his theory, referring the reader for the proof itself to the appendices of *The Abilities of Man*. Using the letter g to express the general factor, and s with different subscripts for the specific factors, we can express the numerical results of four different tests x_1, x_2, x_3 and x_4 as follows, where the Greek letters are 'weights' indicating the relative quantities of each factor

$$x_1 = \alpha_1 g + \beta_1 s_1$$
$$x_2 = \alpha_2 g + \gamma_2 s_2$$
$$x_3 = \alpha_3 g + \delta_3 s_3$$
$$x_4 = \alpha_4 g + \epsilon_4 s_4$$

Or, in functional notation:

$$x_1 = f(g,s_1),\ x_2 = f(g,s_2),\ x_3 = f(g,s_3),\ x_4 = f(g,s_4)$$

Now it has been proved by Dr J. C. Maxwell Garnett that the above factor patterns yield the following correlations between each pair of tests:

$$r_{1\,2} = \alpha_1\alpha_2,\ r_{1\,3} = \alpha_1\alpha_3,\ r_{1\,4} = \alpha_1\alpha_4$$

$$r_{2\,3} = \alpha_2\alpha_3,\ r_{2\,4} = \alpha_2\alpha_4,\ r_{3\,4} = \alpha_3\alpha_4$$

In other words, the correlations depend on the quantity of g only, and are not affected by the quantities of the specific factors. This is obviously reasonable, since the correlation of two quantities can only depend on something common to both.

Taking the above correlations in groups of four or tetrads, and substituting their values, the following tetrad equations result

$$r_{1\,2}\ r_{3\,4} - r_{1\,3}\ r_{2\,4} = 0$$

$$r_{1\,2}\ r_{4\,3} - r_{1\,4}\ r_{2\,3} = 0$$

$$r_{1\,3}\ r_{4\,2} - r_{1\,4}\ r_{3\,2} = 0$$

Or the equations may be written thus

$$r_{1\,2}\ r_{3\,4} = r_{1\,3}\ r_{2\,4} = r_{1\,4}\ r_{2\,3} = \ldots$$

Thus, it necessarily follows, that if the two-factor theory is valid, the tetrad differences *must* all vanish. The same reasoning applies to any tetrad of correlations, which form the corners of any rectangle, selected from a table similar to that given above. Of course, in any actual case the tetrad differences in the equations would not be exactly zero, owing to errors of sampling, and Professor Spearman argues that the actual differences would be distributed by chance, i.e. in accordance with the 'normal' law of errors. Now Professor T. L. Kelley maintains that this cannot be the case. For, since the chance errors in a correlation coefficient are known to be correlated, we ought to expect such errors in the tetrad

differences also to be correlated, and this would not yield a 'normal' distribution. But let that pass; for though the normal distribution may be the real crux in the mathematical proof of the theory, the psychological crux is whether it is necessary to assume two factors only, if the tetrads do tend to the vanishing point, however they are distributed.

The question, therefore, to be considered, is whether the converse is true. If the observed correlations of a number of test results yield tetrad differences which tend to vanish, is the two-factor theory the necessary explanation of the result? Mr R. C Tryon[5] has considered this question, and comes to the conclusion, on statistical grounds, that the zero value of the tetrad equations is not necessarily a proof of the existence of g and s. Whilst it is true that, when the tetrads vanish, the variables or test results can be expressed in terms of two factors, the variables can also be analysed into multiple-factor patterns in a variety of ways. Consequently, the fact that the tetrads vanish is not a unique test of the two-factor theory. The argument by which the result is arrived at may be made clear in symbolic form. Let the numerical results of four different tests x_1, x_2, x_3 and x_4 be expressed in the following functional form, where each different letter should be conceived as itself composed of an array of sub-factors.

$$x_1 = f(a_1,\ b_1,\ c_1,\ d_1,\ m_1,\ n_1,\ o_1,\ w)$$
$$x_2 = f(a_2,\ b_2,\ e_2,\ k_2,\ m_2,\ o_2,\ t_2,\ x)$$
$$x_3 = f(a_3,\ c_3,\ e_3,\ u_3,\ m_3,\ n_3,\ t_3,\ y)$$
$$x_4 = f(a_4,\ d_4,\ k_4,\ u_4,\ n_4,\ o_4,\ t_4,\ z)$$

Some of the factors, e g. w, x, etc., are specific to each test; some, e.g. b, c, u, etc., are common to two tests, some, e.g. m, t, are common to three of the tests, and a is common to all of them, thus corresponding to the general factor.

Those factors of the second and third of these classes,

which are neither specific nor common to all are called *group* factors.

If we now apply J. C. Maxwell Garnett's formula to these factor patterns we get the following correlation coefficients, where the Greek letters represent the 'weights' of the factors with the corresponding English letters. (Thus the values of the second and third quantities in the first equation would be $\beta_1\ b_1$ and $\gamma_1 c_1$ respectively, and so on for all the others.)

$$
\begin{aligned}
r_{12} &= (\alpha_1\alpha_2 + \beta_1\beta_2 + \mu_1\mu_2 + o_1o_2)\\
r_{13} &= (\alpha_1\alpha_3 + \gamma_1\gamma_3 + \mu_1\mu_3 + \nu_1\nu_3)\\
r_{14} &= (\alpha_1\alpha_4 + \delta_1\delta_4 + \nu_1\nu_4 + o_1o_4)\\
r_{23} &= (\alpha_2\alpha_3 + \varepsilon_2\varepsilon_3 + \mu_2\mu_3 + \tau_2\tau_3)\\
r_{24} &= (\alpha_2\alpha_4 + \kappa_2\kappa_4 + o_2o_4 + \tau_2\tau_4)\\
r_{34} &= (\alpha_3\alpha_4 + \nu_3\nu_4 + v_3v_4 + \tau_3\tau_4)
\end{aligned}
$$

The magnitudes of the correlations depend on the sum of the products of the weights of the factors common to the two correlated tests. The two-factor theory assumes that all the above weights are zero except the α's, and that, in consequence the tetrads must vanish. But this is only one of very many possibilities.

For the tetrad equations, as before noted, may be written thus:

$$r_{12}\, r_{34} = r_{13}\, r_{24} = r_{14}\, r_{23} = \ldots$$

If we substitute the values given above, we get:

$$
\begin{aligned}
&(\alpha_1\alpha_2 + \beta_1\beta_2 + \mu_1\mu_2 + o_1o_2)(\alpha_3\alpha_4 + \nu_3\nu_4 + v_3v_4 + \tau_3\tau_4)\\
&= (\alpha_1\alpha_3 + \gamma_1\gamma_3 + \mu_1\mu_3 + \nu_1\nu_3)(\alpha_2\alpha_4 + \kappa_2\kappa_4 + o_2o_4 + \tau_2\tau_4)\\
&= (\alpha_1\alpha_4 + \delta_1\delta_4 + \nu_1\nu_4 + o_1o_4)(\alpha_2\alpha_3 + \varepsilon_2\varepsilon_3 + \mu_2\mu_3 + \tau_2\tau_3)\\
&= \ldots
\end{aligned}
$$

If these last equations are satisfied, the tetrad differences vanish. "It should be immediately apparent that the weights of the different factors in the different variables can take almost an infinite series of values producing very dissimilar r's, and still lead to vanishing tetrads. In fact the more

factors at work, the more one would *expect* the product of each set of two parentheses to balance"

It was by reasoning, on more or less similar lines, that Professor Godfrey Thomson arrived at his 'sampling theory of ability,' according to which, as previously stated, there are a group of factors involved in carrying out any test, such factors being but a sample of the whole number of elemental abilities which the person possesses; in brief, the non-focal theory. He made experiments by means of dice throws and card drawings, and so obtained correlations due to factors selected purely at random His method was to assign the chance numbers, obtained in these ways, to certain letters of the alphabet, thus getting a series of values for 'imitation mental tests.' When the correlations between these chance numbers was worked out, and arranged in a matrix of rows and columns, the criteria of the hierarchical order were satisfied. In fact "it was found that in every case a very considerable degree of perfection of hierarchical order was produced, quite as high as that found in the correlation data of experimental psychology." A hierarchy among correlation coefficients, and consequently the vanishing of the tetrads, may consequently be a chance phenomenon, due to taking a sample instead of the whole population. If this is so, it would not be necessary to invoke any general factor to account for the zero value of the tetrad differences. The difference between the two-factor and the multiple-factor or non-focal theories is that, in the former, all the tetrads are, within the limits of error, exactly zero, whilst in the latter zero is only the most probable value the actual theoretical value being distributed about zero. It has been demonstrated, also, that the more factors there are in operation the smaller the dispersion about zero.

We shall now endeavour to sum up, and to suggest a method of reconciling the apparently conflicting views. The

two-factor theory asserts that the measurement of any ability is compounded of a general and a specific factor. The general factor *g* is constant for each person, but differs from individual to individual; whilst the specific factor *s* varies for each person from one ability to another. The relative importance of the two factors may differ widely in any two abilities of the same person, and in some cases the specific component may be more important than the general. When a Binet or any other approved mental test is given, the final score is the result of pooling the scores of a number of diverse operations. The validity of this procedure rests on the fact that, by pooling the results, the general factor predominates, since it occurs in every sub-test, whilst each specific factor only occurs once in the general pool It follows that any two extensive series of tests will be in accord with each other, for, in both, *g* will occur in all the sub-tests of each series.

On the multiple factor or non-focal theory, ability to carry out any particular test depends on bringing into play one group of specific factors, which act as a unit, out of an indefinitely large number of factors Such specific factors may be reshuffled and combined, in part or as a whole, with others in order to perform another test. The conception of system or organisation may, perhaps, help us to mediate between the two theories, which at first sight appear so divergent. Every cognitive process, which is eductive, depends on some form of mental organisation or systematisation. If we examine the growth of any science we can observe the results of this process of mental systematisation in the most developed form. When the theory of evolution was formulated, for example, its ultimate effect was to bring into one coherent system a mass of facts which had been previously isolated. Similarly, the law of gravitation enabled men to organise their knowledge of detached data about the universe into a more or less consistent and coherent whole; and the theory

of relativity owing to its more thorough organisation of gravitation and other phenomena has superseded this law. In a like fashion the study of comparative philology, by a systematic survey, has enabled students of language to reduce the languages of the world to a few great families in place of an inchoate collection of tongues.

We may say, then, that the process of mental development consists in bringing relatively inchoate data into some degree of organisation, and we may assume that the degree of organisation is an index of intellectual advance. And, just as the individual in a highly organised modern state is a member of many very diverse groups with different functions, though he is the same individual in each; so it is not difficult to see how a person may organise his elemental mental powers in different ways to cope with very different situations. As a professional man he is called on to give his opinion on certain problems, as a member of a learned society he gives his opinion on different facts, as a member of his town council he gives his views on other situations, and as the head of a family he decides on yet different problems. Yet all these diverse judgments, as they proceed from the same individual, have the characteristic colour of his personality, and bear witness to the same form and degree of mental organisation. His views are those which we expect from that particular organised personality. It thus appears that, although the elemental abilities used in different situations may be very diverse, their peculiar manner and degree of systematisation are the same in any one individual; but differ from person to person.

In any mental test, since the test scores indicate the degree of mental maturity, they are also an index of the degree of mental systematisation, which in our view is much the same thing. And since the degree of organisation is constant in any individual at any one period, there is a constant

feature observable in all his activities. Professor Spearman is, therefore, justified by his analysis in concluding that there is a constant *g* involved; and the other hypothesis is sound in its insistence that the factor-pattern or arrangement of the multiple factors is adequate to account for the fact of vanishing tetrad equations. The constant *g*, however, is not a single factor, but a large number organised into one stable group, which functions as a unity.

Professor Spearman has shewn wise caution in refusing to define his constant factor in any but mathematical terms. In one of his formulations [6] he states: "This continued tendency to success of the same person throughout all variations of both form and subject-matter, that is to say, throughout all conscious aspects of cognition whatever, appears only explicable by some factor lying deeper than the phenomena of consciousness. And thus there emerges the concept of a hypothetical general and purely quantitative factor underlying all cognitive performances of any kind. Such a factor as this can scarcely be given the title of 'intelligence' at all; being evoked to explain the correlations that exist between even the most diverse sorts of cognitive performance, it does not deserve a name appropriate to any one particular sort." [7] If the word 'feature' instead of 'factor' were substituted in this statement, it would not differ much from the view I am presenting. He has considered various possible views of the nature of this underlying constant, and was at one time inclined to equate *g* with the quantity of energy that each person possesses, and which he supposed to be constant. But more recently he prefers to replace energy by 'power,' so as to include time as well as energy as constituents of the unconscious constant factor.[8]

Professor W. McDougall, who is a firm believer in the doctrine of mental energy, has further attempted to define this feature of all cognitive processes as "the power of the

individual to concentrate his available energy effectively upon the task in hand." He thinks [9] that "effective voluntary concentration of attention is undoubtedly capable of improvement by practice. Such improvement would seem, in fact, to be the main, if not the only, valuable result of most formal education Long practice in such concentration on tasks not intrinsically interesting, no matter from what motive—(fear of the rod, desire of self-improvement, desire to surpass others, to win a prize, to earn one's daily bread, to win distinction, or to please one's teacher)—does seem unquestionably to strengthen this power of concentration." In our chapter on "*Mental Discipline*" we have seen that whilst there is something to be said for this view, the motive of the task makes all the difference in the world, and is not, as he appears to think, irrelevant. Nevertheless his final conclusion is one that seems to be closely in accord with mine. "For what is the condition of that control and direction of effective concentration of energy which is displayed by all normal human beings in various degrees? I suggest that the reply to this question may be given in one word, *integration*. Animals are but little integrated, and the same is true of the infant. Throughout the early years each normal child becomes more and more integrated, the process being promoted by all activities and forms of training that develop intellect and character. And individuals progress to various points in the scale of integration. In proportion to the degree of integration achieved, the whole mind works as one system which dominates and controls all its parts; in proportion as it does this, it is able to concentrate effectively, to direct available energy into the channels of the dominant activity of each moment"

I have shewn in *The Mind and Its Body* that the concept of mental energy is of such doubtful validity that it had better be avoided in psychological discussions. If we do so,

and bear in mind that systematisation or organisation includes all that is implied by integration, it will be seen that Professor McDougall's view may be reconciled with mine, though he arrives at it by a totally different method.

A notable contribution to the theory of the nature of intelligence, developed by the mathematical analysis of test results, has been made by Professor T. L. Kelley.[10] Though he is in complete sympathy with Spearman's general mathematical outlook and methods, he has criticised the technique and the interpretation of results by which the two-factor hypothesis has been arrived at. This hypothesis, it will be remembered, assumes that in tests which are not similar, only the general factor and specific factors are involved, but that common or group factors would occur when the tests were similar. Thus, different tests of reasoning, owing to the overlap of specific factors in each of them, would exhibit a group factor. Such group factors correspond with those common factors of the multiple factor hypothesis which are not found in all the tests, but only in some of them. A number of such group factors have been analysed out by the two-factor school, the criterion employed being the failure of the tetrad differences to vanish. When this happens, it is assumed that, in addition to the general and specific factors, common or group factors are present. By this method a group factor of reasoning has been distinguished, another of mechanical ability, a third which underlies arithmetical ability, and a fourth on which musical appreciation depends. With his improved technique Professor Kelley has attempted to shew that, not only are there a considerable number of such group factors, but that *g* itself is due to a combination of group factors, which his method can disentangle. Using a picturesque analogy, he says " Mental life does not operate in a plain but in a network of canals. Though each canal may have indefinite limits in length and depth, it does not

in width; though each mental trait may grow and become more subtle, it does not lose its character and discreteness from other traits."

Such an outlook on mental ability is widely different from that of the multiple factor hypothesis, which, as we have seen, postulates an indefinitely large number of elementary traits, certain units of which may act together, but in different combinations when the task is different; much as the pupils in a class at school may be combined in one group for mathematics, in another for cricket, football, dramatics, etc, where the same individual may form part of every different group. And, it may perhaps be added, this analogy is much to be preferred to the above, since it employs living units, for, after all, a mind which performs a test is alive. The general factor *g* is said to be due to inadequate analysis, owing to dealing with results obtained from groups of persons who are not sufficiently homogeneous. It can be proved mathematically that, under certain conditions, the heterogenity of a group may introduce spurious correlations. Now any collection of children, even of the same chronological age, will be a heterogeneous group, as regards degree of maturity, in almost any physical or mental characteristic. In any such group it can be easily shewn "that individuals possessed of two traits between which there is zero correlation (if tested at the same stage of maturity) will shew traits which are correlated when the individuals of the group are tested at different levels of maturity, provided only that there is correlation between the two traits at maturity. Now, the writer is unaware of any mental traits in which growth during the days of childhood does not take place. And thus for all traits in which the status of the child is low in very early life and high at adulthood there is a necessary correlation between the maturity of the traits." [11] Hence the almost universal correlation of mental abilities, which

Spearman first discovered, and which led to the formulation of the two-factor theory.

What is true of maturity is likewise true of any other influence which produces a heterogeneous group, e.g differences of race, sex and nurture. Arguing on these lines, Professor Kelley maintains that the general factor is a spurious result, which can be adequately accounted for by a combination of group factors of varying degrees of heterogeneity. In addition to the group factors previously enumerated, he has analysed out from the general factor other group factors; such as one underlying the manipulation of spatial relations, another for memory, and above all, a verbal factor. He claims that fully one-half of the general factor is represented by this verbal group factor; and, as the proof of the two-factor theory "has not allowed for sex, race, or nurture, and probably not adequately for maturity, it is truly an open question whether any *g* factor at all would exist if these things had been properly taken into account."

Now, it seems to me, that to regard such considerations as maturity, race, nurture, etc. as 'factors' tends to obscure the psychological issue by a mathematical bias. All these are highly important influences which affect test results. But they can hardly be considered as factors in the mathematical sense of the term. A difference of maturity or sex will obviously lead to a difference in the degree or the form of mental organisation. And the effect of nurture, apart from differences of mental content, are wholly explicable in terms of mental organisation. A well-educated person is one who has a well-ordered mind; such systematisation being what education invariably aims at, or should try to produce. A group 'factor' represents a system which has become stable, by the various parts having acquired a particular 'set,' just as a team of players tend to become more and more a unit. So that, once again, we must fall back

on the concept of systematisation as the means by which to reconcile the diverse views reached by the mathematical treatment of test results. The mathematical analysis is indispensable in analysing test scores, but the interpretation of the results obtained by analysis must be accomplished by psychological considerations. Regarded from this angle, a particular factor-pattern represents the form and degree of organisation of a person's abilities. The conflicting interpretations of the analysis of the tests can all be accounted for by assuming that mental tests measure the degree of mental systematisation attained by the person. Such degree is due to a variety of causes, of which maturity is only one, and nurture a much more important influence. We thus reconcile the controversy as to whether tests measure nature or nurture by remembering that, whilst nurture cannot be eliminated, the possibility of attaining any particular degree of mental organisation is innate Education can only provide the material and the opportunity, and help the person to reach that degree of mental systematisation which his constitution is capable of.

It is instructive, before leaving this issue, to note a partial agreement with our view by Professor Thorndike [12] who, as we stated before, has been associated with the development of tests almost from their inception. He thinks that we cannot get nearer to a meaning of intelligence than that given by general opinion, and, therefore, we must accept as measures of intelligence "the measures of different products produced by human beings, or of different ways taken by them to produce the same product, each of these products and ways having value attached to it as an indication of intellect by a somewhat vague body of opinion popular or scientific." He thinks that to restrict our measurements, as Spearman would do, to the introspection of experiences, the educing of relations and correlates

is inadequate; since "analysis, selection, and *organising* seem to be as deserving of consideration as the perception and use of relations" (italics mine). By relying on the consensus of opinion as to what constitutes an intellectual task, he collected a number of well-tried and approved tests, namely the completion test of Ebbinghaus, arithmetical problems, vocabulary tests, and tests for understanding connected discourse or following out directions. Samples of these were given at the end of the last chapter. Finding that these correlated very highly with one another, and with other tasks which are regarded as intellectual, and with the usual tests of intelligence, he employs the above four tests as an adequate measure of what is meant by intelligence.[13] It will be remembered that Binet used a somewhat crude form of this procedure. He, too, selected tasks which he and others regarded as intellectual and then tried them out But he had not at his disposal the method of correlation and the refinements of statistical procedure which have enabled Professor Thorndike to give the method scientific validity. On Thorndike's view, any test is a good test of intelligence, which, if applied to a group of persons, gives numerical results which correlate highly with the reputed intelligence of such persons, as estimated by those who know them well, or by such a test as a Binet-Simon test. And such a view chimes in well with the position we have taken. For, since the same organisation may accomplish many diverse purposes, so the form and degree of mental organisation that a person has reached may be tested by different tests. It is necessary to remember that the final court of appeal, in all mental testing, is the opinion of those who know the testees intimately, and can thus grade them for intelligence to a first degree of approximation.

PERFORMANCE TESTS

All the tests so far considered have been of the verbal type, or at all events have assumed a certain facility in the manipulation of language. And mathematical analysis has, as we saw, shewn that the verbal factor may largely account for the test scores. It is conceivable, however, that intelligence might be displayed by processes which do not demand the use of language. For testing this practical kind of intelligence certain 'performance tests' have been devised.[14] These are practical problems requiring for their solution the manipulation of some concrete material, or the performance of some specific act, which can be accomplished without verbal aid. In all performance tests it is possible that internal speech or verbal imagery may be employed, but such aids are not essential; and the emphasis is on the practical and concrete rather than the symbolic and the abstract. Of such concrete tests, the most frequently used for individual, as opposed to group testing, are the following. The 'maze test' in which a series of mazes graduated in difficulty have to be threaded by a pencil line. Another test is called the 'cube imitation test' and consists of four cubes placed in front of the subject, and tapped one after another in more and more complicated patterns by the tester, and the subject has to reproduce the pattern by tapping them himself. The 'substitution test' consists of a row of different shapes, circles, squares, etc, each with an enclosed number. The shapes are reproduced in rows in diverse orders and the subject has to insert the corresponding numbers in each. In the 'picture completion test' there are various scenes representing a continuous story. Each scene has a square hole cut out and the subject has to fill it in from a number of spare squares As these spare parts are sometimes interchangeable, with disastrous results to the meaning of the

scene, some ingenuity is required for the choice Then there are various kinds of 'formboards' or boards with recesses or insets cut out in different shapes. The subject is given certain problems, in each of which he must work out the minimum arrangement of the blocks in the insets necessary to make room for one or more blocks outside the recesses. The 'cube-construction test' consists of model cubes of different sizes, and a set of smaller cubes from which the models may be built up. The models are painted, and intelligence is displayed in the selection of the appropriately painted smaller cubes to construct the larger, in the least number of moves and in a given time.

All the performance tests are time tests to some extent So that a person who simply gropes about, without any intelligent insight into the meaning of the situation, cannot succeed within the given time In all the above tests a certain amount of manual dexterity is, of course, involved. But it plays no greater part, in some of the tests, than dexterity in using a pen plays in writing an essay. Nevertheless, owing to the importance of such dexterity in many occupations, tests of a simple kind involving mainly deftness of fingers, have been employed for testing fitness for certain simple vocations. A more complicated performance test is a 'test of mechanical aptitude,' consisting of the separate parts of a series of ten common objects, such as a bicycle bell, a door lock, etc., which have to be assembled in a given time. Such a test presupposes not only the ability to perceive the relations of the separate parts, but also some insight into their functions.

For ordinary verbal mental tests, ability increases progressively with age, owing to the fact that mental organisation, as a whole, steadily improves. But for performance tests this is by no means the case. Thus for a group of 570 pupils, whose mean chronological age was 13 years 10 months

but whose average mental age was 12½ years, the following table shews the mental age they appeared to have by the performance tests, using the norms published for each test.[15]

Mazes	*Cube Imitation*	*Substitution*	*Pict Comp.*	*Cube Constr*	*Form-board*
12	13½	15	14¾	13¼	10¼

It is quite clear that it would be a mistake to combine the results of all these tests to arrive at a 'practical' mental age. The abilities involved seem to grow at varying rates, the specific operations, involved in each test, bringing into play relatively discrete mental systems, dissociated from the central mental organisation.

For the more complicated mechanical aptitude tests, analysis by means of tetrad equations has revealed that success is determined by (1) general intelligence, (2) a mental system or group factor concerned with perceiving spatial relations, and (3) the group factor of manual dexterity. The predictive value of such tests for future skill in any occupation must, therefore, depend on the relative importance of each of these organised systems of abilities which a particular kind of mechanical work involves.

An analysis of manual skill has recently been undertaken by Dr J. W. Cox.[16] He, too, found that the processes involved are very complex, and do not mature at the same rate. Analysis, by means of the tetrad equation technique, disentangled four factors, or as we prefer to say, four modes of organisation of abilities. A general factor which, as it had a high degree of correlation with tests of general intelligence, reveals the general mental organisation of the persons. The second and third factors were, respectively, the ability to understand and solve problems involving moving mechanisms, and a factor of manual dexterity. Both these were group factors common to certain forms of skill. And finally, there are specific factors peculiar to each manual operation.

For simpler manual operations, the general factor appears to play no part, and the two group factors are also less in evidence. That is to say, in the simpler manual skills, an isolated organisation of mental aptitudes is at work, dissociated from the general capacity of the person.

An important fact was brought to light in this research, confirming the conclusions we arrived at in the chapter on "*Mental Discipline*" Prolonged practice in one manual operation, such as assembling work of a particular sort, had little or no influence on other kinds of assembling work. When, however, instruction was given in the basic principles underlying assembling operations, a very considerable transfer of skill to other operations, and a greater speed of acquisition ensued. It is thus clear that practice *per se* or unenlightened practice is of very limited scope, and, as it does not provide insight into principles, it is barren ; whereas, instruction in basic principles, since it leads to insight, stimulates the person to further insight and provides him with an incentive to improve. Thus, the same considerations which apply to purely intellectual tasks appear to hold good for questions of manual skill. The incentive given by understanding is sufficient to influence a man's whole intellectual organisation. On the other hand, mere practice, without insight, is dissociated from the general intellectual life, and not taken up into the general organisation.

CHILD GUIDANCE

The original purpose for which mental tests were devised was to discover the lower grades of intelligence, in order that mentally defective children might receive suitable educational guidance But the progress of research has extended the use of the tests to those who are normal and supernormal.

Many educational authorities in Great Britain employ a mental test in order to pick out those pupils whose intelligence is sufficient to enable them to profit by a secondary education. The usual method of selection is to give a scholastic examination in Arithmetic and English, but in some cases this is supplemented by a mental test. The question, therefore, arises as to whether such a test has a predictive value over and above that of the scholastic tests Obviously the way of deciding the matter is to find out which of the tests correlates to a greater degree with success in secondary school work In a recent investigation in an English county[17] pupils were selected for secondary education on an admission examination consisting of English, Arithmetic and a mental test, to each of which equal weight was assigned. The progress of every pupil was, thereafter, estimated each year by the teachers in the different schools, and at the end of five years a special assessment was made of the suitability they had shewn for the secondary school course A group of nearly 120 pupils, whose assessments corresponded closely with the results of the School Certificate Examination, was then selected from several schools, thus providing an independent criterion of the school records. The correlation coefficients between the separate subjects of the entrance examination and the final school assessment were as follows: Arithmetic ·25, English ·42, Intelligence test ·48. When the marks of the scholastic and intelligence tests were combined the coefficient was found to be ·53. Hence the intelligence test has most predictive value and arithmetic least, whilst a combination of scholastic and mental tests is best of all.

Mental tests are now employed, not only to guide education authorities but to give help to parents and teachers in the important matter of child guidance, for 'difficult children.' Psychological tests are but one of the several means

employed to get a diagnosis of children who are maladjusted, for child guidance is an art rather than a science, and employs a variety of means to get a clear view of the case A quarter of a century ago, in Chicago, Dr W. Healy [18] was the pioneer in bringing to bear a battery of psychological, medical and social data on the investigation of youthful delinquents. The idea rapidly spread in America, and child guidance clinics were established in various towns in order to use the same methods to deal with difficult behaviour cases of all kinds, and not only delinquents. In 1927 the East London Child Guidance Clinic was the first to be established in Great Britain and others have since been founded. " The child guidance clinic is an attempt to marshal the resources of the community on behalf of the children who are in distress because of unsatisfied inner needs, or are seriously in conflict with their environment—children whose development is thrown out of balance by difficulties which reveal themselves in unhealthy traits, unacceptable behaviour, or inability to cope with social and scholastic expectations." [19] It deals with such children by attempting to find out and remove the deeper causes of maladjustment. The Hadow scheme of reorganisation in England is an attempt to provide a variety of schools to meet the needs of varying intellectual capacities. But, even when it is complete, we have to realise that the capacity to utilise educational opportunity is as fundamental as the opportunity itself. A child's reaction to educational opportunity is a function of several variables, chief amongst which are his inheritance, his health, psychological development, and his family and social environment. Early maladjustments arising from any of these causes may lead to emotional stresses which breed the neurotics, the social inferiors, the rebels and the mentally unstable. Owing to the plurality of causes which may produce a badly adjusted person, child guidance clinics employ the services of the psychiatrist, the

psychologist and the social worker, whose combined findings are focussed to serve as a guide for diagnosis and treatment.

Children who are treated at such clinics are usually those whose intelligence is normal, and whose difficulties are traceable to some emotional strain between the child and its parents or other relatives, or teachers, or to a lag between the child's capacity and his school work, or it may be some extreme form of anti-social behaviour, or some deep-seated personality difficulty. Thus in the East London Child Guidance Clinic [20] out of the 1,200 reasons, relating to boys and girls up to seventeen years of age brought for treatment over a period of seven years, the order of frequency of the different symptoms was as follows. Nervousness, excitability 255, Backwardness 130, Beyond control 115, Theft 124, Enuresis 87, Aggressive, destructive 70, Unmanageable at school 63, Masturbation, sex difficulties 36, Night terrors 45, Temper tantrums 43, Stammer 45, Habit spasms or nervous movements 30, other speech difficulties 29, Inability to keep a job 26, Depression 15, Truancy 21. The other symptoms, roughly 6 per cent of the total, occurred with a lesser frequency. The same child may, of course, and often does, display more than one symptom. The task of the clinic is to trace these symptoms to their underlying causes. It is sometimes found that the ultimate cause is not mainly in the child, but in some emotional imbalance of the parents who are then either enlightened as to their own condition, or some treatment is suggested to them, as a result of which they may change their attitude towards the child and thus resolve the difficulty In some cases the difficulty may be met by placing the child with foster-parents for a limited period until the emotional strain is relaxed

Each child receives a fourfold study, social, physical, psychological and psychiatric. The home environment is investigated by a social worker, and a physical examination

by the doctor may bring to light certain unsuspected physical defects. Such defects may not be important for general health, but may influence a child's feeling about himself, and so contribute to his emotional situation. Individual psychological tests of the Binet-Simon type are given, and the intelligence quotient is found. Should the child prove mentally defective, he is referred to the appropriate institution, as such cases are not treated in guidance clinics. Of 300 children brought to the clinic named above two-thirds had I.Q.'s either normal or super-normal. Selected performance tests are also given, and this affords the psychologist a good opportunity of observing the temperamental behaviour of the child. An important part of a clinic is a playroom where, unknown to himself, the child's social behaviour is carefully observed In this way some estimate of his social attitudes is gained, and information on all such matters is also obtained from parents and teachers. Emotional difficulties of the child may have the widest repercussion on his whole mental development, including his ability to cope with his school tasks. Thus, it was found that over 30 per cent of the children brought to the clinic for general backwardness had either normal or supernormal I.Q.'s. So, their scholastic backwardness cannot be attributed to mental retardation, as parents and teachers are sometimes apt to suppose, but lies probably in some emotional cause. On the other hand, there is much evidence to show that specific backwardness, such as linguistic or arithmetical disability, may engender a severe feeling of inadequacy and consequent emotional disturbances. These, and neurotic symptoms generally, are the special province of the psychiatrist, who gets a general impression of the child at one or more interviews.

When all the above data have been collected, a staff meeting is held to which all interested in the welfare of the child, including parents and teachers, are invited. At this

meeting all the facts are pooled and discussed, and a diagnosis of the case, and methods of treatment are suggested. Such integration of the facts, in the light of each other, is perhaps the most important single contribution which the child guidance clinic has made to the problem of child behaviour. The object aimed at is to better the child's total adjustment to life, rather than the removal of a symptom. It is the symptom which distresses the parent or the teacher, but to deal with that alone is futile; for such deviations from normality must not be regarded in isolation, but interpreted in the light of the child's total reactions to life. Thus some children have been known to steal in order to give presents to their friends; by this lavishness attaining a sense of superiority in order to overcome an inferiority complex When dealt with in this combined way, by those who have a sympathetic understanding of children, it is found that more than half the cases can be satisfactorily adjusted Apart from the help given to 'difficult' or maladjusted children, the spread of child guidance clinics will, in the long run, change the attitude of teachers and parents to the behaviour of the normal child; just as the investigation of the intelligence of the defective child has contributed so markedly to our views on normal and supernormal intelligence.

VOCATIONAL GUIDANCE

Another field in which the value of mental tests has been adequately proved is that of vocational guidance, though here, also, the tests are only one of many considerations brought to bear on the problem. The complexity of the modern business and professional world, with the ever-growing sub-division of functions, makes it impossible for parents or teachers to have the necessary knowledge to give

adequate advice Moreover, a young person's interest in a definite occupation is by no means a certain criterion of his suitability for it He may be interested in engineering, but lack the intelligence to pass any of the examinations required. On the other hand, a test may show that an adolescent has a degree of intelligence sufficient for a specific occupation, but he may lack the necessary temperamental or other personal qualities essential for success in it. In 1921 the National Institute of Industrial Psychology [21] began a series of researches into this complex problem, which are still in progress. At first it was thought that the problem could be tackled on purely scientific lines, by means of suitable general tests of intelligence, and tests of aptitude for specific occupational processes It was hoped, in this way, by analysing abilities and occupations to fit one into the other. But it soon became evident that this approach was much too simple. Moreover, it has become clear that we shall never be able to devise special vocational tests for every occupation. Like child guidance, vocational guidance is becoming recognised as an art, in which an array of data must be assembled, and considered in the light of a variety of different considerations. Moreover, the determination of vocational aptitude must vary greatly with the age of the person to be advised. The scientific data must be delicately balanced, and wisdom, tact, and discretion are as essential in the adviser as they are for a physician who is to win the confidence of his patient.

The methods adopted by the National Institute are being gradually improved in the light of experience; but it will help to crystallise our ideas if we give an account of an experiment conducted by them with 1,200 pupils, of the approximate age of fourteen years, about to leave elementary schools.[22] A procedure which is suitable for this age must be considerably modified for adolescents of the age of sixteen to eighteen years. Nevertheless, the underlying principles

are, perhaps, more clearly discerned at the earlier age, since the problem is infinitely more difficult, as the pupils are still largely unspecialised Of the 1,200 boys and girls half formed a control group, who received the advice ordinarily given to a pupil about to leave school; whereas the others were advised on the basis of a careful consideration of the integrated data derived from various sources For each pupil of the experimental group information was obtained and classified under the following heads: home conditions, a thorough medical examination, intellectual capacity, and character traits The information about the homes was obtained from the teachers or from visits, which enabled the investigators to form some estimate of the vocational plans of the parents, and the pupils' hobbies and other interests. The medical examination was able to rule out certain occupations such as those involving good sight, muscular or nervous strain, exposure to weather and so forth, where there were contra-indications against these.

Some attempt was made to get a survey of the total personality, as shewn by the impression that was left on the minds of the investigators, teachers, etc. with whom the pupil came into contact. However difficult this may be, and it is undoubtedly impossible except for those who have natural intuition into character, it is evident that the personality as a whole, as distinct from separate items within it such as temperament, special interests, etc., is by far the most important consideration in giving vocational advice. Various temperamental tests have been devised to assess temperamental differences, but so far none has proved satisfactory, and reliance has to be placed on general impression. By a like method of impression, at close range, an attempt was made to assess various emotional and moral qualities which are necessary in vocations. A schedule was drawn up referring to such things as appearance and manner, general

attitude such as alertness, carefulness, etc , leadership as shewn in assertiveness, self-confidence, etc. ; general instinctive tendencies such as fearfulness, etc. ; emotionality as exhibited in excitability or apathy, and so forth. These were graded on a five-fold scale, and teachers indicated the point on the scale they thought appropriate. Some similar system is now in use for older pupils, and the parents and teachers of those seeking individual guidance fill up a schedule before the applicant is examined. For, it is obvious that inappropriate or undesirable character traits may obscure valuable intellectual qualities, and, on the other hand, such features as persistence may compensate for lack of quickness. Many of the above characteristics were manifested during the subsequent psychological examination, and recorded as an impression by the psychologist.

Each pupil was submitted to a group test of intelligence and the intelligence quotient was obtained. This was followed by a variety of performance tests, both those in which the appreciation of spatial relationships determined success, and the others ; as enumerated in an earlier section of this chapter. By this means, certain special abilities of a mechanical nature were disclosed. As in the case of child guidance, all these data, character traits, physical condition, home conditions, general and specific capacity, are co-ordinated and integrated at a conference at which the various investigators and the teachers are present. The method adopted, in deciding how to employ the data, is that of progressive elimination. Thus the pupil's I.Q. limits the range of possible occupations. The range is further limited when his temperamental and character traits are taken into account. Some idea is thus obtained from the integration of his intelligence, his abilities and his character, of the broad kind of occupation for which he is best fitted : whether for work dealing primarily with people, such as a salesman ; with concrete things, such as some

form of skilled labour; or with books, writing, or figures, such as a clerk. And finally any medical findings such as poor physique, liability to nervous strain, etc. will limit the scope once more In some cases, but in a very few, it is possible to confirm the indications afforded by these data by a vocational selection test, which has been standardised within some given occupation, such as dressmaking, clerical work, etc. And the parents' wishes and the pupils special tastes and ambitions may be the best guide of all, in centring attention on a limited range of occupations most suitable to his capacities

It is clear that, when this stage is reached, the conclusion can only be valuable if the vocational advisers are intimately familiar with the structure of industry, and the opportunities available within it. They must also be familiar with the methods of entry, such as conditions of apprenticeship, length of training necessary and so on. When a decision is finally reached a choice of two or more suitable occupations is suggested to the parents, with an indication of the reasons.

Now the virtue of all this elaborate method rests on the assumption that certain qualities and abilities will make for success and happiness in certain occupations, and also that it is possible to establish some degree of congruity between such abilities and the tasks demanded by specific occupations. In various foreign countries, where vocational guidance has been established, these assumptions are accepted without question, but in Great Britain the National Institute has attempted to verify them. In the experiment, which we have described, a scale of five degrees of congruity, A, B, C, D, E, was drawn up; the highest being assigned to an occupation in which the person would find a chance to develop his general and special abilities, and the lowest to those occupations in which the inquiry shewed that he was extremely unlikely to be successful or happy Certain criteria were used to gauge

the suitability of the occupation undertaken, namely the length of tenure of the post, the employer's report on the efficiency of the employee, and the employee's liking for the work.

The efficacy of vocational guidance is to be sought in a positive association between each of these criteria and the degree of congruity between the post taken by the pupil and the advice given. The 1,200 pupils were 'followed up' for periods ranging from one and a half to four years, and 85 per cent of them were traced. Those who received the expert advice showed a consistently greater tendency to remain in one post, when it was of the kind advised, than when it was different; whereas those of the control group (who received only the amateur advice usually given) did not shew this tendency to the same degree. The employers' reports on the workers' efficiency were classified into three classes according to their degree of satisfaction. In the experimental group first-class reports occurred more frequently in connection with the posts of grades of congruity A and B, than with posts of grades D and E; whilst, conversely, reports of the third class occurred more frequently in connection with posts of grades D and E than in any of the others. A similar double relationship was found in the control group, but not to anything like the same degree. Finally, the workers' expressed satisfaction or dis-satisfaction was compared with the grades of congruity. It was found that satisfaction tended to be associated, more often, with posts of high degree of congruity than with those of low degree, in both groups. The two former criteria are the best, since a person's satisfaction may be due to causes having little relation to the suitability of the work, and on both these grounds the method of vocational guidance has justified itself.

Further researches of a like nature, with improved technique, have been undertaken in Cambridge, Birmingham and

Fife,[28] and the results amply confirm the correctness of the advice given. If we call an accordance post one which conforms with the advice given, and a non-accordance one which does not, the following results were found in Fife for 85 children who were given guidance and followed up for two to four years.

No of Children	*In Accordance Posts*	*In Non-accordance Posts.*
Satisfied with their work	35	22
Dissatisfied with their work	3	25

In Birmingham the investigators had the advantage of an intimate knowledge of local employment conditions There were 330 boys and girls divided into an experimental and control group The former received the expert advice, the latter the usual advice given to elementary school children on leaving school. The table shews the percentage of first posts retained throughout a follow-up period of two years.

	In Accordance Posts	*In Non-accordance Posts*
Exp. Group ·		
Boys	21	1
Girls	35	4
Control Group		
Boys	7	15
Girls	20	15

Allowing for the fact that girls are less likely to seek fresh posts than boys, we see that the drift of children to other posts is far greater in the experimental group when the first post is *not* in accordance with the advice given than when it is in accordance; whereas in the control group the drift was far less, or even reversed in direction.

So far we have dealt exclusively with elementary children of the age of fourteen years, but there is evidence dealing with secondary and public school pupils who leave school at the ages of sixteen to nineteen years Nearly two hundred such individual cases have been advised by the National

Institute, and followed up for a period of two to three years, with the following results.

	In Accordance Posts	*In Non-accordance Posts.*
Satisfied with their work	132	29
Dissatisfied with their work	12	19

Thus satisfaction is eleven times more frequent than dissatisfaction in accordance posts, and only about one and a half times as frequent in the other The feasability of successful guidance may, in the light of these facts, be regarded as established. It only remains to introduce the principles into the schools.

A growing number of schools have careers masters and mistresses, and it is desirable that these should have some training in the methods of vocational guidance. An expert psychologist, attached to the staff of the Local Education Authority, should guide their work and co-ordinate local efforts The schools have one advantage over any central organisation in the matter, in that they can get a cumulative record of a pupil's progress. But, of course, the schools cannot have the knowledge of industry which only experts can give. Nevertheless, they can readily get assistance and information from expert authority and enlighten pupils and parents by means of pamphlets, lectures and films. The careers master should keep a *cumulative* record concerning the pupils on a file, which ought to include the results of psychological examinations, medical history, notes on temperament, character, special interests such as hobbies and the like, provided by masters who know the pupils intimately. Vocational advice would thus be the last step in a continuous process carried out during the pupil's whole school career. The function of the careers master should be to try to adjust the pupil's ambition to his proved capacities, as established by the cumulative record. It is not his business to attempt

to force the pupil's inclination, but to persuade him, in such a manner that the pupil makes his own choice in the light of relevant information. The careers master can help him to rule out occupations unsuitable to his abilities, and guide him to a provisional decision as to the general type of work most fitted to his capacities and temperament. He must remember that the facts he accumulates for vocational guidance are only direction posts, and not definitely marked out tracks along which the pupil must travel to a successful and happy career.

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14. Piéron. *Op. cit*, p 147 The article contains a very acute analysis of mental imagery

15. Imagery in Imaginative Literature. Peers. *Journ. of Exp Pedagogy* Vol. 2 (1913–14)

16. Conditions which arouse mental images in thought C. Fox. *Brit. Journ. of Psy* Vol 6

Also Bartlett on Functions of Images Same journal Vol 11 Comstock, Relevancy of Imagery, etc. *Amer Journ of Psy* Vol. 32 (1921).

17. Titchener *Op. cit*, p 19

18 On meaning Pillsbury *Psy. Review* Vol 15 (1908)

19. The Phenomenon of Meaning Ogden *Amer. Journ of Psy* Vol. 34 (1923).

20. Titchener *Op. cit* Gives an admirable summary of this work.

21. *Family Life of Heine*, p 149. Translated by Leland. Heinemann (1896)

22 Forster's *Life of Dickens* Bk 9, ch 1.

23. *Memories of Whistler*. Way. Lane (1912)

24 A Qualitative Investigation of the Effect of Mode of Presentation, etc O'Brien. *Amer. Journ of Psy* Vol 32 (1921).

The following papers may, with advantage, be consulted:

On the Nature of Images. G. Dawes Hicks *Brit Journ. of Psy* Vol. 15 (1924). The view taken is very similar to that suggested in this book; though it is arrived at on general grounds.

Factors in the Mental Process of School Children. Carey. *Brit. Journ. of Psy* Vol. 7.

A Revision of Imageless Thought Woodworth *Psy Review.* Vol. 22—one of the best articles on the topic

On Meaning. A Symposium *Psy Review* Vol 15.

An Objective Interpretation of Meaning. Kantor *Amer. Journ. of Psy.* Vol. 32.

Meaning and Imagery Moore. *Psy. Review.* Vol 24.

A useful book on some points of this chapter is *The Meaning of Meaning* Ogden and Richards. *Int Lib Psych* (1923)

For Eidetic Imagery Allport *Brit Journ of Psy* Vol. 15 (1924) Note especially the looseness of the whole investigation

25 Skill Hunger, and Technique *A.M A. Journal*, Nov. 1933.

CHAPTER VI

HABIT FORMATION

1 *The Republic* Bk 7, 518 E Jowett's translation

A similar view to Plato's is held by Dewey who says "All virtues and vices are habits which incorporate objective forces. They are interactions of elements contributed by the make-up of an individual with elements supplied by the out-door world They can be studied objectively as physiological functions, and can be modified by change of either personal or social elements." *Human Nature and Conduct* Sect 1 Allen & Unwin (1922) The author thinks that the study of habit is the key to social psychology and develops this view philosophically

2. *Story of My Life* Ch 3 Hodder & Stoughton (1903)

3. Groves *Dictionary of Music* Art Handel.

4. *Memoirs* of Benvenuto Cellini, by himself Bk 1, sect 7.

5. *An Outline of Psychology*. Ch 6 Methuen (1923).

6 *The Great Society* G. Wallas Macmillan.

7. Dewey *Op cit* Sect. 1

8. Bryan and Harter Studies in the physiology and psychology of the telegraphic langugage *Psy Review*. Vols 4 and 6 (1897–9). These are still the most exact and complete studies of the habit curves, and repay careful reading.

9. The significance of learning curves. Peterson. *Journ of Exp. Psy* Vol. 2 (1917)

10. Artificial syllables of 3 letters, such as wov, nim, etc. These must be constructed in accordance with a very rigid plan (see Myers *Text-book of Exp Psy*) so as to eliminate meaning as far as possible This is not always possible and some psychologists think their artificiality militates against their utility

11. A translation of Ebbinghaus' original paper is given in *Memory* Columbia Teachers' College (1913)

12. G. Wallas. *Op cit* Ch 5.

13 Experiments in Learning, etc Smith and McDougall *Brit. Journ of Psy* Vol. 10 (1919–20).

14. Dewey *Op. cit.*, p 71.

15 *Principles of Psychology* Vol. I, ch 16, p 663.

16. James. *Op. cit* Vol I ch 4, p. 108.

17. On this whole section admirable accounts are given in two books in the *Int. Lib. Psych.*, namely, Köhler's *Mentality of Apes* (1925), and Koffka's *Growth of Mind* (1924)

18. *Philosophical Writings of Leibniz*. Section on 'New Essays.' Everyman Series. Dent (1934).

19 *The Mind and its Body* Ch 8 Internat. Lib. Psych., 1931.

20 *The Energies of Men* W McDougall Methuen (1932)

21 *Maternal Behaviour in the Rat.* Wiesner and Sheard. Oliver & Boyd (1933).

22 *Jocasta's Crime* Ch 25. Lord Raglan Methuen (1933).

Note —Most of the extensive literature on Habit is tarred by the physiological brush The following articles by Piéron are strongly recommended, Sur les phénomènes de mémoire, etc *L'Année Psychologique* (1913) . Recherches comparatives sur la mémoire *L'Année Psychologique* (1920).

CHAPTER VII

MEMORY

1 Butler's *Unconscious Memory* Fifield (1910) Ch. 6 contains a translation of Hering's famous lecture on Retentiveness called 'On Memory' See also Butler's *Life and Habit* Fifield

Consult also Rignano on *Biological Memory*. Int Lib Psych (1925).

2. *Matière et Mémoire* Ch 2 Bergson F. Alcan Paris (1908).

3. Some experiments in learning and retention. Smith and McDougall *Brit Journ of Psy* Vol. 10 (1919–20) A very suggestive article containing useful experiments and methods.

4. Memory and the direction of associations Wohlgemuth. *Brit. Journ of Psy* Vol. 5.

5. Ward's *Psychological Principles.* Camb. Univ. Press Ch 4, par. 7.

6. The Relation of Length of Material to Time taken for Learning, etc. D O. Lyon. *Journ. of Educ. Psy.* Vol 5 (1914). An account of heroic experiments extending over four years

7. *Remembering.* F C. Bartlett. Camb Univ Press (1932).

8. Obliviscence and Reminiscence *Monograph Supplement.* Vol. 1 *Brit. Journ of Psy.* (1913)

9 A Study in Logical Memory S. D. Austin. *Amer. Journ. of Psy* Vol. 32 (1921). This art really deals with memory and not with habit which is the bane of articles on the subject

10. Should Poems be Learnt by School Children as 'Wholes' or in 'Parts'? Winch. *Brit. Journ. of Psy.* Vol. 15 (1924)

This art. is vitiated by the antiquated methods used by the children in the schools.

11. *Introd. Lectures on Psycho-Analysis.* Ch 4. Eng. tr. Allen & Unwin (1922). Also Freud's *Psycho-pathology of Everyday life* Fisher & Unwin (1920).

12. *Instinct and the Unconscious.* Camb. Univ. Press (1920). Appendix 1

13. Influence of Feeling on Memory Wohlgemuth *Brit. Journ. of Psy.* Vol. 13 (1923) Also Influence of Subjective Preference on Memory C Fox Same vol of *Brit Journ. of Psy*

14. *Text-book of Exp. Psy* Ch. 13, p 165 Camb Univ. Press (1911).

15. Mach. *Science of Mechanics* Ch. 4, sect 4.

16. *A Short History of Education* J. W Adamson. Camb Univ Press.

17. *The Primary School* Appendix 3 H.M. Stationery Office (1931).

18 *Mental Physiology.* 6th ed (1881), ch. 10

19. *Psychology for Teachers,* p 70, Arnold (1906).

20. *Principles.* Vol. 1, ch. 16.

21. A Comparison of the Effects on Retention, etc. Eaglesham. *Brit Journ. of Ed. Psy.* Vol. 1 (1931)

An interesting theory of forgetting has been put forward by A. Lynch in his *Principles of Psychology,* pt III, ch 2, G Bell & Sons (1923). By learning considerable extracts of poetry by heart and testing himself at long intervals he found that he could remember the ' inspirational ' parts but not the parts which merely served to connect these, i e. the ' padding ' In this way he thinks it is possible to analyse a work of art æsthetically, on the ground that " the essential characteristic expression of a passage is retained, and the accidental forgotten " If this is so, it is a striking confirmation of the influence of interest on memory dealt with in the text.

CHAPTER VIII

MENTAL DISCIPLINE

For the earliest experiments the following books give good summaries.

Educational Psychology Vol. II, ch. 12. Thorndike. Kegan Paul (1913).

The Learning Process Chs 14, 15. Colvin. Macmillan (1911).

The Educative Process. Ch. 13. Bagley Macmillan (1914).

1. Plato's *Republic.* Bk VII, 526 B and 527 C The first extract is Jowett's translation amended, and the second has been retranslated as he does not give the exact meaning.

2 See Locke's *Educational Writings* Ed by Adamson Camb Univ Press, and an art by Phillips in *Brit Journ of Psy* Vol 13, p 1

3 *Essays on a Liberal Education* Ch 2 Macmillan (1867) Art by H Sidgwick The book is a series of arts, giving the point of view of the best thinkers of the period

4. *Schools Inquiry Commission* (1868) Vol 5, p 677

5 Same Commission, vol 5, p 726 Also see the evidence given by other women witnesses, and Adamson's *English Education* Ch 9 Camb Univ Press (1930)

6 *Essays on a Liberal Education* Art. by Wilson, p 267.

7 *Principles* Vol I (1890), ch 16, p 666, *note*

8 Memory and Formal Training *Brit Journ of Psy* Vol 4 (1911)

It is difficult to understand why the doctrine was called " formal training." Its more modern name of ' transfer of training ' is un-

intelligible—what we are looking for are the *effects* or *consequences* of training The best name of all would be *generalised* training.

9 Transfer of Training in relation to Intelligence Brooks. Critique of Methods of Estimating and Measuring Transfer of Training Gates Both in *Journ of Ed Psy* Vol 15 (1924)

10. Methods and Results of a Class Experiment in Learning Dearborn and Brewer *Journ. of Ed. Psy* Vol 9 (1918)

11 A Comparison of Two Types of Learning *Journ of Ed Psy.* Vol 9 (1918).

12 An Exp Investigation into Transfer of Training Langdon & Yates *Brit Journ of Psy* Vol 18 (1928)

13. Mental Discipline in High School Studies *Journ of Ed Psy* Vol. 15 (1924)

14 General *v* Group Factors in Mental Activities Thomson. *Psy Review* Vol 27 (1920)

15 Ward's *Psychological Principles* Ch 3, par 1

16. *Mentality of Apes.* Ch 8. Kohler Int Lib Psych (1925) An excellent book on the topic of this chapter. Who would have expected apes to solve the problem!

17 *Brit. Med Journ* Aug. 1923, p. 256

18 *Republic* Bk VII, 531 E.

19. Russell *Mysticism and Logic.* Ch. 4 Longmans (1921). On the study of mathematics The whole book should be read

There is a vast literature on the topic of the chapter, but a good deal of it is invalid owing to primitive mental atomism, or crude associationism which now masquerades under a new name, to wit 'mental factors'; but the more it changes its designation the more it remains the same The various volumes of the *Journ. of Ed. Psy.* will provide copious references

See also *The Mind and its Body,* C Fox, Int. Lib. Psy (1931), where the latest work is given

CHAPTER IX

SUGGESTION

1 *The Psychology of Suggestion* B. Sidis. Appleton (1911)

2 *Instinct and the Unconscious.* Rivers. Camb Univ. Press (1920)

3. *La Suggestibilité* Binet, Schleicher Frères Paris (1900) A very useful book with interesting experiments and dealing with suggestibility in the normal life. See also, De la suggestibilité naturelle, *Rev. Psychol.*, vol 38 (1894), pp. 337–47 Binet et Henri.

4. *The Master and his Boys,* p 18 ff. S S Harris. Warren & Son Ltd. Winchester (1925)

The whole book is worthy of very careful study The quotation given in the text deals incidentally with 'sneaking,' a topic which is admirably dealt with by Simpson in *An Adventure in Education.* Sidgwick & Jackson (1917)

5 *Mental and Scholastic Tests,* p. 195. P S King (1921)

6. *Life of Lord Rayleigh*, by his son Arnold (1924).

7. An Experimental Study of Sensory Suggestion. Edwards *Amer Journ of Psy* Vol 26 (1915).

8. Individual and Sex Differences in Suggestibility Brown *Univ. of California Publications in Psy.* Vol. 2, No. 6 (1916)

9. Trotter. *Instincts of the Herd in Peace and War,* quoted by Hart in *Psy. of Insanity*, p. 105 Camb Univ Press.

10. Quoted in Mill's *Logic* Bk II, ch 3, par 3

11. The influence of the form of a question. Muscio. *Brit Journ of Psy* Vol. 8 (1915–17)

12. *Suggestion in Education* M. W. Keatinge Black

13 Keatinge. *Op cit*, p 125

There is not much of value concerning suggestibility in the *norma state*, collected together in any one volume or article But the following contain useful points not referred to above Suggestion and Mental Analysis Brown. Univ. of London Press (1922) Suggestibility With and Without Prestige in Children Aveling and Hargreave. *Brit. Journ of Psy* Vol 12 (1921–2)

CHAPTER X

PSYCHO-ANALYSIS

1. *Instinct and the Unconscious* Ch. 2. W H R Rivers Camb Univ Press

2. A Study in Feeling and Emotion Flugel. *Brit Journ of Psy* Vol. 15 (1925)

3. *New Introductory Lectures on Psycho-Analysis* Ch 31 Freud Hogarth Press (1933)

4 Dissertation on the Nature of Virtue *Collected Works*

5 The Relation of Complex and Sentiment *Brit Journ of Psy* Vol 5 *The Foundations of Character* A F Shand Macmillan (1914)

6 *A Neglected Complex* Bousfield Kegan Paul (1924)

7 *Introductory Lectures on Psycho-Analysis* Ch 6, p 90 Freud Allen & Unwin (1922)

8 *The Neurotic Constitution* Adler Kegan Paul (1921) *Individual Psychology* Adler Int Lib Psych (1924)

9. *Childhood's Fears* Morton Duckworth (1925)

A study by a head master illustrated by cases of his own pupils He calls the complex ' inferiority—fear-complex '

10 *The Neurotic Constitution* Introd p. xii

11 *Introductory Lectures on Psycho-Analysis*, p 298 Freud has another Principle called the Reality Principle See his *Collected Papers*. Vol 2 (1924)

12 *Three Contributions to the Theory of Sex* Freud Nervous and Mental Disease Publishing Co Washington 2nd ed (1920)

13. *Youth and the Race* Edited by Marchant Kegan Paul (1923) This consists of the evidence given before the National Birth Rate Commission

14. *The Neurotic Constitution*, p. 31 ff.

15 *Three Contributions, etc*, p 62

16. *Op cit*, p 55

17. *A Critical examination of Psycho-Analysis* Ch. 7 Allen & Unwin

A clever examination of the subject Should be read by everybody who has been infected by the doctrines The principles are examined in a light and witty style but very acutely.

18 *Papers on Psycho-Analysis* E Jones. Baillière Tindall & Cox (1913) See the chapter on Psycho-Analysis and Education which is simply a restatement of Freud's views

19 *Psychology of Sex*. Ch 3 Havelock Ellis Heinemann (1933) A mine of information in condensed form

20 *Child Psychology* Rasmussen. Gyldendal See vol 2 The Kindergarten Child

21 See Wohlgemuth, *op cit.*, ch 7, for parts of this analysis.

22 Rivers *Op cit* Chs 15 and 16

23. Bousfield *Op cit* Ch 3.

24 *Youth and the Race* Dr Sibly's evidence, p 183 Dr Rivers also gave evidence and referred, apparently with approval to the doctrine of infantile sexuality, adding that he knew nothing about it from his own experience

25. *Psychology of Sex* Ch 3. Havelock Ellis. Heinemann (1933).

26 *Education and Biology*. Ch 3 J A Lauwerys Sands & Co. Contains some useful suggestions.

27. *Youth and the Race* Evidence of the head master of Charterhouse.

Note.—I have not referred to the minor psycho-analysts since they simply deal with detail and add nothing to our general knowledge.

CHAPTER XI

ÆSTHETIC APPRECIATION

1 Accuracy in Representational Art. T. E. Dickson. *Brit. Journ of Ed Psy* Vol. 3 (1933)

2. B. Russell. *Mysticism and Logic* Ch 4. Longmans

3. J. W. Adamson. *Short history of Ed* Camb. Univ. Press Ch. 1

4. Croce *The Essence of Æsthetic*, transl by Ainslie Heinemann (1921)

5 *The Place of Music among the Arts* Sir Henry Hadow. Oxford Univ. Press (1933).

6. *Principles of Literary Criticism.* Chs. 7 and 8 I. A. Richards. Int. Lib. Psych (1934).

7. *Beauty and other Forms of Value* S Alexander. Macmillan (1933)

8. *The Name and Nature of Poetry* A. E. Housman. Camb. Univ. Press

9 *Art and Common Sense.* S C. Kaines Smith Medici Society (1932)

10. Bréal. *Semantics*, trans. by Cust Heinemann (1900). *The King's English.* Clarendon Press *The Meaning of Meaning* Chs 9 and 10. Ogden and Richards. Int Lib Psych (1923)

Seeing that the use of language is the most dictinctive human characteristic it is a matter of wonder that Semantics is not more widely studied by psychologists

11. A happy translation of the Ger Einfuhlung

12. Preface to 2nd ed *Lyrical Ballads* (1800).

13 Poems of Coleridge, ed. by E H Coleridge, p 503. Oxford Univ. Press (1912)

14 *Analytical Psychology* Chs 11 and 14 Jung. (1917.) Also *Psychological Types* Int Lib. Psych (1924).

15. *Brit Journ of Psy* Vols 2 and 3 Arts by Bullough Vol 7 Art by Myers and Valentine Vol 13 Art by Myers

16. *The Place of Music among the Arts* Sir Henry Hadow Oxford Univ. Press (1923)

17 *The Name and Nature of Poetry* A E Housman Camb Univ Press (1933)

18 *Florentinische Nachte* Page after page of Ch 1 is a detailed series of romantic pictures induced by music

19 *L'Art* Ch 2 Rodin Grasset Paris (1924)

20. *Op. cit*

21. *After Strange Gods* T. S Eliot Faber & Faber

22 Psychical Distance, etc Bullough *Brit Journ of Psy* Vol 5

23. *The Play Way* H Caldwell Cook. Heinemann

24. See the chapter on Mental Imagery.

25. *The Gentle Art of Making Enemies*, by Whistler

26 As Lamborn in the *Rudiments of Criticism.* Ch. 9. Clarendon Press (1916) This is the sole objection to an otherwise suggestive and admirable book

27 *Victorian Poetry* Pt 2, ch 3. J. Drinkwater Hodder & Stoughton (1923).

28. *Principles of Literary Criticism* Ch. 10. I. A. Richards Kegan Paul (1934)

29 Indiv. Diffs in listening to music. *Brit Journ. of Psy.* Vol. 13 (1922)

30 *The Music of Life.* C. T Smith P S King & Son (1919).

31. Published by the Gramophone Co, 363 Oxford St, W.

32 Lamborn *Op. cit* See also Perse Playbooks Heffer (Cambridge)

33 See chapter on Mental Imagery

34 The Nature of Rhythmic experience Isaacs *Psy Review* Vol 27 (1920)

35 See the *Play Way* H Caldwell Cook

36. *Rhythm, Music and Education* Dalcroze Chatto & Windus (1921) Also an art in *Psyche* Vol 5, p 121

Reference may also be made to Some exps on Æsthetics Feasey, *Brit. Journ of Psy.*, Vol 12, and an art by Wheeler in Vol 13

On the subject of Rhythm in nature see *Life* Ch 12. Shipley, Camb Univ. Press.

An excellent account of æsthetic theory is to be found in *The Beautiful*, by H R Marshall Macmillan (1924). More recently the field has been covered by Richards in *Principles of Literary Criticism* Int. Lib Psych (1925).

37. *Recent Developments in School Music*. B of Ed Pamphlet 95. H M. Stationary Office

38 Effect of Creative Work on Æsthetic Appreciation K. B Leopold *Brit Journ. of Ed. Psy.* Vol. 3 (1933)

39. The Criterion of Accuracy in Representational Art T E. Dickson. *Brit. Journ of Ed. Psy.* Vol 3 (1933).

40 *Training of Taste in Arts and Crafts.* Littlejohns and Needham Pitman (1933)

CHAPTER XII

MENTAL TESTS—I

The study of mental tests should begin with the various articles in *L'Année Psychologique*. See especially

A propos de la mesure de l'intelligence. Binet (1905)

Méthodes nouvelles pour faire le diagnostic différentiel, etc Binet and Simon (1905).

Le développement de l'int chez les enfants Binet and Simon (1908)

Nouvelles recherches sur la mesure du niveau intellectuel, etc Binet (1911).

L'echelle métrique de l'intelligence, etc Saffiotti (1912). Deals with a novel method of marking the tests

1 *Montessori and her Inspirers* Fynne Longmans (1924).

2 *Education as a Science*, p 16. Bain, 5th ed. (1885).

3 *Inquiries into Human Faculty*. Everyman Series. Dent.

4. *Psychological Method of Testing*. W Stern Warwick & York (1914)

5. The term ' mental ratio ' is preferable to Intelligence Quotient (I.Q) since the latter presupposes that the tests measure Intelligence but the name has become universally adopted

6 The Mental Age Concept L L Thurstone. *Psy. Review* Vol. 33 (1926).

7. *Measurement of Intelligence* L. M. Terman. Harrap (1916)

8. Both published by P S. King & Son (London) Useful bibliographies are given.

9. A point scale for measuring mental ability. Yerkes and Foster. Warwick & York (Baltimore), 1923.

10 Results of Re-tests by means of the Binet Scale. Wallin. *Journ. of Ed. Psy.* Vol. 12 (1921) Same journal Vol. 14 (1923), p 231

11. Additional Re-tests by Stanford Revision Garrison *Journ. of Ed. Psy.* Vol. 13 (1922)

12. Constancy of the Intelligence Quotient. Gray and Marsden *Brit. Journ. of Psy.* Vols 13 and 15 (1923 and 1925).

13. I have omitted dec. points in this and later cases owing to their

doubtful value. See Notes on Interpretation of Correlation Measures Hamilton. *Forum of Ed.* Vol. 2 (1924)

14. Constancy of the Stanford-Binet I Q , etc *Journ. of Ed Psy* Vol 12 (1921)

15. *Journ of Ed. Psy* Vol 14 (1923), p 247 Art by Henmon and Burns.

16. Constancy of the I.Q. C. L Nemzek *Psychological Bulletin* Vol. 30 (1933). This sums up all the preceding work

17. The limit of the growth of int. P W Ballard *Brit. Journ. of Psy* Vol. 12.

18 Investigation of group int. tests Dobson *Brit Journ of Psy.* Vol. 15 (1924)

19 *Psychological Tests of Educable Capacity* H M Stationery Office (London, 1924.) Gives a bibliography

20 I have tried the same group tests on 28 Cambridge graduates and the average mark was 161

21 Interpretation and Application of I Q Freeman *Journ. of Ed Psy* Vol. 12 Growth of Int and the I Q Same vol Art. by Peterson. Rate of Mental Growth. Brooks. Vol 12.

22 A method of scaling psy and ed tests Thurstone *Journ of Ed Psy* Vol 16 (1925) Improvement in Int scores from 13 to 19 Thorndike. Vol 17 (1926) *The Mental Growth Curve* Thurstone and Ackerson Vol. 20 (1929). Analysis of a complex of statistical variables, etc H Hotelling. Vol 24 (1933).

23 The growth and variability of intelligence Richardson and Stokes *Brit. Journ of Psy* Monograph Supplement XVIII

24 On the inadequacy of the partial correlation technique. Burks *Journ of Ed. Psy.* Vol 17 (1926)

25. *Mental and Scholastic Tests among Retarded Children* Gordon. Board of Ed pamphlet No 44. H.M Stationery Office

26 Social and Geog Distribution of Int , etc. Duff and Thomson *Brit. Journ. of Psy* Vol 14 (1923).

27. *Intelligence of Scottish Children* Univ. of London Press (1933)

28 *Mental Tests in the American Army* Yoakum and Yerkes Sidgwick & Jackson (1920)

29. An Application of American Army tests Bowie *Brit. Journ. of Psy.* Vol 13 (1923)

30 The Northumberland Mental Tests Thomson. *Brit Journ of Psy.* Vol 12 (1921)

31 Pub. by Hodder & Stoughton (1922)

32. Mental Tests for Selection of Univ. Students. Rogers. *Brit Journ. of Psy.* Vol. 15 (1925)

33 Comparison of certain Int Scales Wilson *Brit Journ of Psy.* Vol 15 (1924) The other tests were Terman's, Otis, National and Simplex

34 Reliability of Rankings by Group Tests, etc Geyer *Journ of Ed Psy.* Vol. 13 (1922)

35 Some of the best will be found in Burt's Mental and Scholastic Tests. A full account of their use for diagnostic purposes is given in *The Year Book of Education* Evans Bros. (1935)

36 *A Measure of Int* C. Spearman Methuen (1925)
37 *Child Psychology.* Vol 2 Rasmussen Gyldendal
38. *Psy. Tests of Educable Capacity,* p. 229

The following should also be consulted
Education and World Citizenship Maxwell Garnett Camb Univ Press. *Proceedings* of VIIth International Congress of Psychology (1924) Camb Univ. Press. Communications on *Nature of Intelligence,* and *Conception of Nervous and Mental Energy*

CHAPTER XIII

MENTAL TESTS—II

1 Int. and its Measurement *Journ. of Ed. Psy.* Vol. 12 (1921).
2 General *v* Group factors in Mental ability, Thomson *Psy. Review* (1920)
General Int. Objectively Determined Spearman *Amer. Journ. of Psy* (1904)
Essentials of Mental Measurement, Brown and Thomson. Camb Univ Press (1921)
Manifold theories of the two factors Spearman *Psy Review* (1920).
3 The Two-Factor Theory, etc. C. Spearman *Brit. Journ of Ed. Psy* Vol. 1 (1931)
4 Multiple Factors *v.* Two Factors. R. C. Tryon *Psy Review,* Vol 39 (1932) gives a succinct proof of the method.
5 Multiple Factors *v.* Two Factors R C. Tryon *Psy Review.* Vol. 39 (1932)
6. *Nature of Intelligence* Ch 1 Macmillan (1923).
7. *Abilities of Man.* Ch 9. Macmillan
8. The Theory of Two-Factors, etc. *Brit Journ of Ed Psy.* Vol. 1 (1931).
9. On the Nature of Spearman's General Factor *Character and Personality* Vol. 3 (1934)
10 *Crossroads in the Mind of Man.* T L Kelley Stanford Univ Press (1928).
11. T. L. Kelley *op cit* Ch. 2
The quotation is slightly altered verbally, to make the point clear.
12. *The Measurement of Intelligence* Teachers' College Columbia Univ Press.
13. Present-day Theories of Intellectual Factors. Ll. Wynn Jones. *Brit. Journ of Ed Psy* Vol. 3 (1933).
14 *Use of Performance Tests, etc* Industrial Fatigue Research Board. H.M Stationery Office. Report 53 (1932)
15 *Use of Performance Tests, etc*
16. *Manual Skill, etc* J W. Cox Camb Univ Press (1934).
17 Predictive Value of Int Tests for Secondary Education. J. W. Collier *Brit. Jour. of Ed. Psy.* Vol 3 (1933).

18. *The Individual Delinquent* W Healy. Little, Brown & Co. (1920).

19 *Child Guidance Clinics.* G. J Stevenson and J Smith. Oxford Univ. Press (1934)

20. *Report of the Director* (1933), to be obtained from the Secretary, Woburn House, W C 1

21. Report 5 (1934), issued by the Institute, Aldwych House, W.C.2

22. *Methods of Choosing a Career.* E. M Earle Harrap (1931)

23. *Contribution to the Problems of Vocational Guidance* Report of Nat Inst. of Industrial Psy

The mathematical treatment of the two-factor and sampling theories is dealt with in the following references J Mackie (1929) *Proc Roy Soc Ed*, vol 49, E B Wilson (1928), *Proc Nat Acad Sc*, vol 14, H T H Piaggio (1933 and 1934), *Brit Journ Psy*, vols. 24 and 25, W Brown (1935), *Brit Journ Psy*, vol 25, J O Irwin (1932, 33, 35), *Brit Journ Psy*, vols 22, 23, 25

A complete account of the different varieties of mental tests and their applications is given in *The Year Book of Education* (1935) Section III Evans Brothers Ltd., Russell Square, London

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